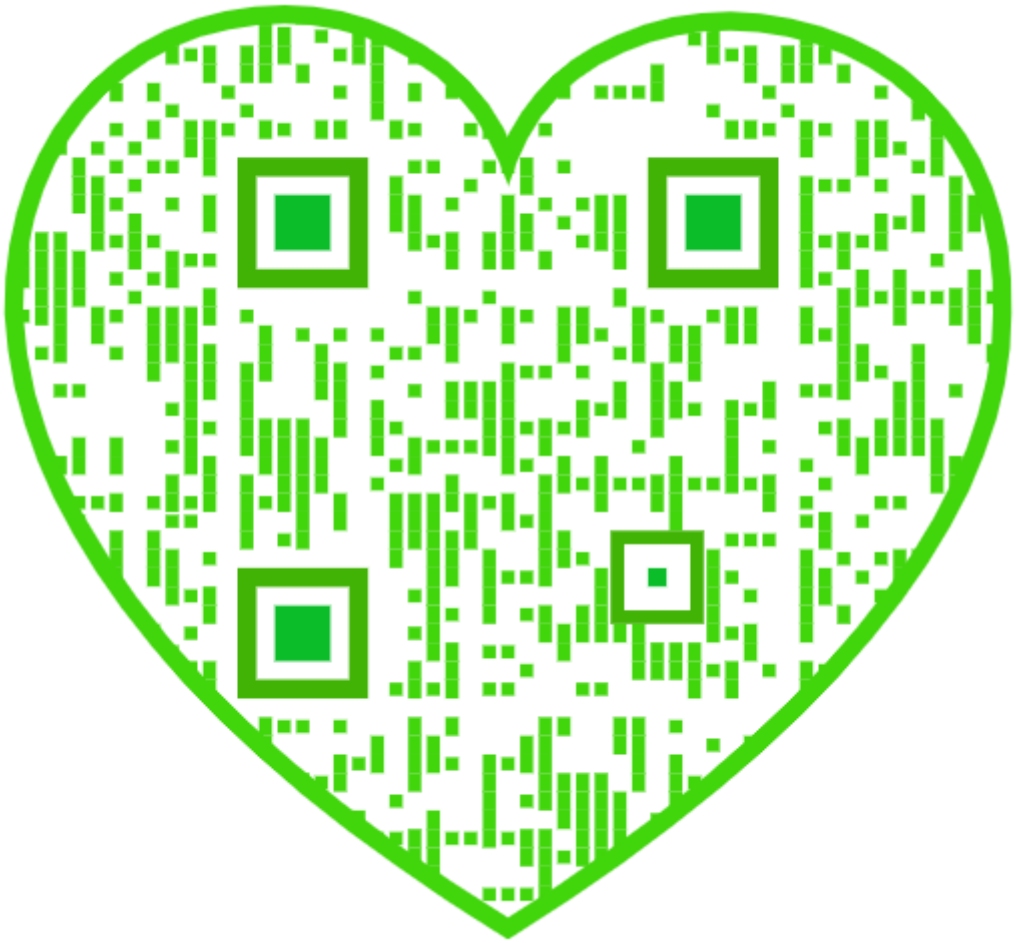

A PRACTICAL

TREATISE

ON

SURGICAL DIAGNOSIS

DESIGNED AS A MANUAL FOR PRACTITIONERS
AND STUDENTS IN MEDICINE

BY

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THIRD EDITION—THOROUGHLY REVISED, ENLARGED, AND PROFUSELY ILLUSTRATED.

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TO

THOSE PROFESSIONAL FRIENDS

WHO HAVE

SPRUNG UP AROUND ME

DURING MY EARLY LITERARY EFFORTS,

AND

WHO HAVE KINDLY AIDED ME IN MY LATER CONTRIBUTIONS

BY

THEIR VALUABLE COUNSEL, SUPPORT AND ENCOURAGEMENT

This Work is Dedicated

BY

THE AUTHOR.

PREFACE TO THE SECOND EDITION.

SCARCELY more than a year has yet elapsed since the first edition of this work was given to the public. At that time, the question whether the plan of the book would meet professional favor was certainly an open one, and it affords some personal gratification that the increasing demand for the work, both as a text-book and as an aid to the general practitioner, justifies a revision of its matter and an addition to its former pages.

I have changed my opinion somewhat since this work was first issued, as to the advisability of employing the plan of *contrast of symptoms*, in the form of differential tables, to the exclusion of descriptive text; as I have found that, however valuable they might be as a summary to the student, or as an aid to the practitioner at the bedside, such tables alone will not fill the requirements of a text-book, or be as generally useful as if accompanied by a concise and general enumeration of the etiology and symptomatology of each of the more important diseases to which the attention of the surgeon is most often directed, and which must, therefore, form the basis of most lectures given to the student.

In preparing this revised edition, I have followed, as far as my judgment approved, all those suggestions which have from time to time been made to me by different instructors throughout the country, and have endeavored to make this volume especially valuable and attractive to the student in medicine, as well as to those more advanced in their knowledge of disease.

The work, in its present form, cannot be called elementary in any sense, nor is that, in my opinion, a desirable quality in a text-book; but it will, I trust, be found improved by the additions made, and better fitted for the purpose for which it was at first intended.

In this edition, all errors of statement have been carefully expunged where detected by the author, and the first three sections of the present volume have been rendered much more complete than in the first edition of the work.

In the section upon "Diseases of the Male Genitals," many additions and improvements have been made; and in the section upon "Diseases of the Abdomen," the subject of hernia has been enlarged and many smaller alterations incorporated.

I have introduced, as a preparation for the study of "Diseases of Tissues," a hasty summary of inflammation, arranged in a tabular form, which is rather an outline sketch than a full résumé, but which may possibly prove of some little value to those who need some guide to follow in studying more extensive treatises, or who wish to understand the first elements of pathological changes.

A new index of this work has been made, which will be found quite complete, as the amount of new matter which has been added demanded it, and as the one of the previous edition did not seem to fill all the requirements of a book of reference. In the pages of bibliography, appended at the close of the volume, the full titles of the volumes from which extracts have been made have been supplied, where previously omitted, with the date and place of publication, as a guide to those who wish to consult authorities upon any special subjects.

It is not probable that everything has been added that would give additional value to the book, but time and the continued use of the work as a text-book will enable the author to be further enlightened as to its requirements.

The author begs, in closing, to acknowledge the valuable hints afforded him in some of the able reviews of the first edition, and many other personal friends, who have also made suggestions of value; also to his friend and student Henry C. Moir, for the valuable assistance which he has rendered him in preparing an index, which, from its completeness, will greatly facilitate reference, and thus add to the value of the work.

156 MADISON AVENUE,
April, 1880.

PREFACE TO FIRST EDITION.

AT the request of my private classes I publish this volume.

As a text book for students it will, I trust, aid memory by presenting the symptoms of diseases in *marked contrast;* while to the practising physician it may prove a book of easy reference, when questions of diagnosis arise leading towards doubt or error.

I am aware that many points of distinction given will admit of question, as authorities do not always agree. I have, however, selected from such authors as, in my opinion, best merit attention, and have avoided as far as possible all points on which argument is demanded, or from which serious error is liable to follow.

I have endeavored to make, in most instances, selections for contrast of such diseases as are most liable to be confounded, and, for perspicuity, have been forced to frequently duplicate the symptoms of many of them.

In this volume all questions of etiology, pathology and treatment have been purposely omitted, as they have no direct bearing upon diagnosis, and therefore do not properly appertain to it.

Each differentiation is, in most instances, so arranged as to allow the symptoms of each to be reviewed separately by reading from *above, downwards;* while by reading *across* the page the points of contrast become prominent.

The "Common Symptoms" written below each differentiation explain, in general, the possible causes of error in diagnosis.

At the close of this volume will be found enumerated under the head of bibliography those authors to whom I am indebted for many statements advanced and from whom occasional extracts have been given. I have adopted this method of acknowledgment since the arrangement of disease in a *tabulated form* precludes the frequent interpolation of authorities. Confusion would thus often result unless explanatory paragraphs were also inserted and the object of marked contrast in symptoms would be thus thwarted.

If I succeed in placing before students and the medical profession at large a work whose system and arrangement will probably be its chief recommendation, the object of this volume will have been accomplished.

156 MADISON AVENUE,
January, 1879.

PREFACE TO THE THIRD EDITION.

THE adoption of this work by several medical colleges as a text-book, and the encouraging support which it has also received from the profession at large, have prompted the author to increase its scope, and, in addition, to eliminate all errors in the edition now exhausted, to which his attention has been called.

The improvements which have been made comprise the addition of two chapters upon the diseases of the Brain and Spinal Cord and their Envelopes, and a most careful revision of the previous chapters.

In the two new chapters, the desire of the author has been to present in an accessible form the chief points which are essential to an accurate diagnosis and localization of the more common lesions. The difficulties of the task have been greatly enhanced by the necessity of condensation. The author would refer those readers who desire more anatomical information upon these subjects to his work, "The Applied Anatomy of the Nervous System," and also to various articles which he has published in the *Journal of Nervous and Mental Diseases*, the *Medical Record*, the *New York Medical Journal*, and the *Archives of Medicine*.

The author takes pleasure in expressing his deep obligation to those medical instructors who have made suggestions, from time to time, regarding additions to, or modifications of his work, which a continued use of it as a text-book in their classes had brought to their minds.

The publishers have kindly granted the author the privilege of illustrating this edition. Some of the cuts are original, but the majority have been selected from the later works upon surgery and nervous diseases. They have been arranged to suit the descriptive text, as far as it was possible, without destroying the plates of the previous edition. It is hoped that they will add to the value of the work.

Dr. J. Lee Richmond has kindly assisted the author in the revision of the proof and the preparation of the index.

156 MADISON AVENUE, N. Y. CITY,
December, 1883.

CONTENTS.

PART I. DISEASES OF THE BLOOD-VESSELS.

GENERAL table of diseases of the blood-vessels. Atheroma, its causes and diagnostic symptoms. Fatty degeneration of vessels, its causes and symptoms. Aneurism, its varieties, its causes, its most frequent situations; the conditions affecting its growth; the general symptoms of aneurism and their diagnostic value; the symptoms of special forms of aneurismal tumors; the differential diagnosis of aneurism in general. Occlusion of Arteries, its etiology and symptoms. Diseases of the veins: Hypertrophy of the venous coats, its causes and symptoms. Atrophy of veins, its causes and surgical importance. Degeneration of the venous coats, its varieties, causes, and diagnostic importance Adhesive inflammation of veins (thromballosis). Suppurative inflammation of veins (diffuse phlebitis), its causes and symptoms. Varicose veins Parasites of veins. Phlebolithes (calculi of veins). Tables of contrast of symptoms headed as follows: Aneurism and tumor on an artery. Aneurism and erectile tumors. Aneurism and aortic pulsations. Aneurism and abscess over a vessel. Diagnoses of special types of Aneurism: Abdominal aneurism and abdominal tumors. Abdominal aneurism and painful diseases of abdomen, Abdominal aneurism and psoas abscess, Thoracic aneurism and intra-thoracic tumors. Thoracic aneurism and pulmonary consolidation with a murmur in some large vessel, Aneurism of bone and cancer of bone, Cirsoid aneurism and pulsatile tumors of bone, Aneurism and encephaloid cancer, Aneurismal varix and aneurism, Cirsoid aneurism and erectile tumors, Cirsoid aneurism and nævi, Aneurism of arch of aorta and aneurism of the innominate artery, Varicose aneurism and aneurismal varix, Varicose aneurism and varicose veins. Diseases of the arterial coats: Atheromatous degeneration, Fatty degeneration of vessels Diseases of the veins: Adhesive phlebitis, Suppurative phlebitis. Abnormal conditions of vessels: Embolism, Thrombosis.....Pages 1–47

PART II. DISEASES OF THE JOINTS.

General classification of joint diseases. Synovitis, its causes, varieties, and general symptoms. Acute synovitis, its causes and points of diagnosis. Suppurative synovitis (acute articular abscess), its causes, symptoms, and points of differential diagnosis. Chronic synovitis, its causes, symptoms, and differential diagnosis. Scrofulous synovitis, its causes, symptoms, and differential diagnosis. Rheumatic synovitis, its causes, symptoms, and differential diagnosis. Gouty synovitis, its causes and symptoms. Gonorrhœal synovitis (gonorrhœal rheumatism), its causes and symp-

toms. Syphilitic synovitis, its diagnostic symptoms. Arthritis, its causes, symptoms, and varieties Chronic rheumatic arthritis (rheumatic gout, morbus coxæ senilis), its causes, most frequent situation, and symptoms. Anchylosis of Joints, its varieties, causes, and symptoms. Dropsy of joints (hydrarthrosis), its causes and symptoms. Articular neuralgia, its causes and symptoms. Loose cartilages in joints, varieties, situation, and symptoms. Tables of contrast of symptoms of joint diseases, headed respectively. I. *Diseases of the joints in general:* Synovitis and rheumatic inflammation of joints, Scrofulous synovitis and hydrarthrosis, Acute arthritis and chronic rheumatic arthritis, Acute arthritis and syphilitic periostitis near a joint, Acute arthritis and suppuration external to a joint, Bony anchylosis and fibrous anchylosis. II. *Diseases of special joints:* Morbus coxarius, its varieties, its common symptoms, its diagnosis. Congenital dislocation of the hip-joint, its symptoms and differential diagnosis. Sacro-iliac disease, its causes, symptoms, and differential diagnosis. Tables of contrast of symptoms of the more important diseases of special joints. Differential diagnosis of morbus coxarius and congenital dislocation of the hip, Morbus coxarius and psoas abscess, Morbus coxarius and sacro-iliac disease, Morbus coxarius and trochanteric disease of the femur, Morbus coxarius and lateral curvature of the spine, Morbus coxarius and rheumatic deformity of the hip, Morbus coxarius and disease of the crest of the ilium, Morbus coxarius and inflammation of the psoas bursa, Morbus coxarius and infantile paralysis. Diagnostic points of tenderness in inflammation of the larger joints. III. *Deformities of joints:* General classification. Talipes, its varieties, Symptoms of talipes varus, Talipes valgus, Talipes equinus, Talipes equinus with paralysis of the extensors of the toes and flexors of the tarsus, Talipes valgus (spurious), Calcaneo-valgus of moderate severity (Chinese foot), Flat foot, Diagnosis between spurious valgus and sprain of ankle joint.....Pages 48–96

PART III. DISEASES OF BONE.

Classification of bone diseases. Osteitis, its causes, symptoms, and differential diagnosis. Osteo-myelitis, its causes, symptoms, and differential diagnosis. Abscess of bone, its causes, most frequent seat, symptoms, and differential diagnosis. Periostitis, its varieties, causes, and symptoms. Hypertrophy of bone, its causes and symptoms. Atrophy of bone, its causes and symptoms. Rachitic condition of bone, theories as to its cause, its symptoms, and differential diagnosis. Mollities ossium (malacosteon, fragilitas ossium, etc.), its causes and symptoms. Caries, its causes, pathology, symptoms, and differential diagnosis. Necrosis, its stages, causes, symptoms, and differential diagnosis. Cancer of bone, its most frequent situation, and its symptoms. Osteo-aneurism (pulsatile tumors of bone). Enchondroma, its causes, situation, symptoms, and differential diagnosis. Exostosis, its varieties, causes, and symptoms. Cystic tumors of bone (osteo-cystoma), varieties, causes, situation, and symptoms. Fibro-cystic tumors of bone (osteo-sarcoma). Fibrous tumors of bone. Entozoa of bone. Tables of contrast of symptoms of the principal diseases of bone: Osteitis and osteo-myelitis, Caries and necrosis, Osteitis and periostitis, Periostitis near a joint and acute arthritis, Abscess of bone and arthritis, Rickets and malacosteon, Exostoses and cysts of bone, Cancer of bone and pulsatile tumors of bone, Pulsatile tumors of bone and aneurismal tumors. Local types of bone diseases. Abscess of the antrum, Solid tumors of the antrum, Cystic tumors of the antrum, Malignant tumors of the antrum, Extra-cranial tumors, Intra-cranial tumors, Exostoses of the cranium.....Pages 97–132

PART IV. DISLOCATIONS.

Definition, varieties, causes, and general symptoms of dislocation. Dislocations of special joints: I. *Dislocations of the jaw:* Differential diagnosis between the unilateral dislocation and bilateral dislocation, Unilateral dislocation and congenital dislocation, Dislocation of jaw and chronic rheumatic arthritis of the tempero-maxillary articulation. II. *Dislocations of the shoulder:* Classification of the varieties. Differential diagnoses between "Sub-glenoid" dislocation and fracture of neck of humerus, "Sub-clavicular" dislocation and "sub-spinous" dislocation, "Sub spinous" dislocation and separation of the great tubercle of the humerus, "Sub-coracoid" dislocation and "supra-coracoid" dislocation. Comparative table of the three more important dislocations of the humerus at the shoulder joint. Dislocations of the clavicle. Varieties and etiology. Subluxation of outer end of clavicle (dislocation of scapula). III. *Dislocations at the elbow joint:* Classification of. Differential diagnoses between both bones of forearm backwards and fracture of humerus above the condyles, Both bones of forearm backwards and radius forwards, and ulna backwards, Both bones of forearm backwards and both bones of forearm forwards, Both bones of forearm backwards and ulna alone backwards, Radius forwards and radius backwards, Ulna forwards and ulna backwards. Comparative table of the dislocations of both bones of the forearm at the elbow joint. IV. *Dislocations at the wrist:* Dislocations of the carpus, of the separate carpal bones, of the lower end of the ulna. Differential diagnoses between dislocation of the carpus and Colles' fracture, Dislocation of the carpus and sprain of the wrist joint, Dislocation of the carpus and transverse fracture of both bones close to the wrist joint, Dislocation of the carpus and separation of the epiphyses of radius and ulna. Symptoms of dislocation of the lower end of the ulna forwards and backwards, and of dislocation of the os magnum. V. *Dislocations at the hip joint:* Varieties of dislocation of the upper end of the femur. Differential diagnoses between "dorsum ilii" dislocation and "sciatic notch" dislocation, "Sciatic notch" dislocation and fracture of the femur with inversion of the foot, "Pubic" dislocation and "thyroid" dislocation, "Pubic" dislocation and fracture of the neck of the femur, Dislocation of the hip and contusion over the trochanter. Table of contrast of the symptoms of each dislocation of the hip. VI. *Dislocations at the knee joint:* Varieties of dislocation of the tibia and of the patella. Symptoms of dislocation of the tibia forwards, backwards, in rotary displacement, in lateral displacement. Symptoms of dislocation of the patella inwards, outwards, upwards, and in rotary displacement. VII. *Dislocations at the ankle joint:* Varieties of dislocation of the astragalus. Symptoms of dislocation of the astragalus forwards, backwards, externally, internally, and upwards. Differential diagnosis between dislocation of the astragalus upwards and fracture of both bones of the leg, Dislocation at ankle and a severe sprain, Dislocation at ankle and a previous deformity associated with injury.....Pages 133-186

PART V. FRACTURES.

Definition, Varieties of fractures of long bones. Fractures of flat bones. General symptoms of fracture. Classification of special fractures. I. *Fractures of the skull.* Classification of varieties. Differential diagnoses of complete fracture of the skull and tract of outer table only, Fracture of outer and inner tables only, Fracture of inner table only, and apoplexy with complicating injury, Fracture of the base of

the skull and cerebral concussion. Cerebral compression and cerebral concussion II. *Fractures of the upper jaw.* III *Fractures of the lower jaw.* Differential diagnosis from dislocation of lower jaw. IV. *Fractures at the shoulder joint.* Classification. *Fractures of the scapula.* Differential diagnoses between fracture of body and the spine of the scapula, Fracture of the neck of the scapula and fracture of the neck of the humerus, Fracture of the neck of the scapula and dislocation of the humerus. *Fractures of the clavicle.* Varieties of, and their location. Differential diagnosis between fracture of clavicle inside of coracoid process and fracture outside of the coracoid process. *Fractures of the humerus* near the shoulder joint. Varieties of, and their location. Differential diagnoses between simple intra-capsular fracture and simple extra-capsular fracture, Impacted intra-capsular and impacted extra-capsular fractures, Fracture of the neck of the humerus and "sub glenoid" dislocation, Fracture of the neck of the humerus and fracture of the neck of the scapula, Separation of the great tubercle of the humerus and "sub-spinous" dislocation. V. *Fractures at the elbow joint.* Varieties of, and their location, Differential diagnoses between fracture of the condyles of humerus, fracture of coronoid and olecranon process, Fracture of the olecranon process and rupture of the triceps tendon, Fracture of the upper ends of radius and ulna, Transverse fracture of humerus and dislocation at elbow joint. VI. *Fractures near the wrist joint.* Varieties of, and their location. Differential diagnoses between Colles' fracture and dislocation of the wrist, Fracture of both bones near wrist and dislocation of carpus, Separation of the epiphyses and dislocation of the carpus, Colles' fracture and transverse fracture of both bones near the wrist joint. VII. *Fractures near the hip joint.* Varieties of, and their location. Differential diagnoses between simple intra-capsular fracture and simple extra-capsular fracture, Impacted intra-capsular and impacted extra-capsular fracture, Intra-capsular fracture of the femur and chronic rheumatic arthritis with contusion, Fracture of femur with inversion of the foot and "sciatic notch" dislocation of the femur, Fracture of the neck of the femur, and the "pubic" dislocation of the femur. VIII. *Fractures at the knee.* Varieties of, and their location. Fractures of the patella. IX. *Fractures at the ankle.* Transverse fracture of both bones of the leg. Pott's fracture. Fractures of the malleoli. Compound fractures of ankle joint. X. *Fractures of the trunk.* Fractures of the sternum. Fractures of the vertebræ. Fractures of the ribs. Differential diagnoses between fracture of the ribs and the dry stage of pleurisy associated with contusion, Fracture of the ribs and pneumothorax of a traumatic origin, Fracture of the ribs and emphysema of tissues, Fractures in general in the vicinity of joints and dislocation of bone.....Pages 187–254

PART VI. DISEASES OF THE MALE GENITALS.

I. *Diseases of the testicle.* Inflammatory orchitis. Syphilitic orchitis. Tubercular orchitis. Malignant orchitis. Cysts of testis. Sarcoma of testis. Hæmatocele of testis. Lipoma of testis. Fibrous tumors of testis. Enchondroma of testis. Benign fungus of testis (hernia testis). Chronic induration of testis. Arrested development of testis. Congenital malformations of testis. Neuralgia of testis. Atrophy of testis. Incomplete descent of testis. Calcareous deposit of testis. Differential diagnoses between acute orchitis and neuralgia of the testis, Syphilitic orchitis and tubercular orchitis, Malignant orchitis and syphilitic orchitis, Cysts of testicle and hydrocele, Benign fungus of testis and cancer of testicle with fungous growth, Orchitis and epididymitis. Diagnostic table of the four principal enlargements of the testicle. II. *Diseases of the tunica vaginalis and the spermatic cord.* Simple hydro-

cele. Hydro-sarcocele. Congenital hydrocele. Encysted hydrocele of the testis. Diffuse hydrocele of the spermatic cord. Encysted hydrocele of the spermatic cord. Varicocele. Cirsocele. Table of causes of varicocele. Lipoma of the spermatic cord. Spasm of the cremaster muscle. Differential diagnoses between hydrocele and scrotal hernia, Varicocele and scrotal hernia, Encysted hydrocele and cysts of the testicle, Hydrocele and congenital hernia, Hydrocele of the cord and inguinal hernia, Hydrocele and hæmatocele. III. *Diseases of the bladder.* Malformation of, and its varieties: Deficiency of, Multiplicity of, Extroversion of. Inflammatory conditions: Acute cystitis, Chronic cystitis, Ulceration of the bladder, Suppuration of the vesical walls, Gangrene of the bladder. Hypertrophy. Tumors of the bladder. Bar at the neck of bladder. Hernia of the bladder. Inversion of the bladder. Rupture of the bladder, its causes, symptoms, and means of positive diagnosis. Calculi of bladder, etiology, number, and volume, consistency and appearance, shapes, rational symptoms, physical signs, rules for sounding, causes of error in sounding. Foreign bodies in bladder. Tubercle of bladder. Paralysis. Atony. Spasm. Neuralgia. Retention of urine. Incontinence of urine. Overflow of urine.

Differential diagnoses between cancer of the bladder and vesical calculus, Rupture of the bladder and retention of urine, Retention of urine and suppression of urine, Retention and incontinence due to overflow, Acute cystitis and stone in bladder, Paralysis of bladder and atony of bladder, Chronic cystitis and chronic prostatitis. IV. *Diseases of the prostate gland.* Inflammatory conditions: Acute prostatitis, chronic prostatitis, Prostatic abscess. Hypertrophy of the prostate. Atrophy. Cancer. Tubercle. Cystic disease. Prostatic calculi. Prostatic hemorrhage. Prostatic phlebolites. Wounds of the prostate. Differential diagnoses between acute prostatitis and chronic prostatitis, Hypertrophy of the prostate and organic urethral stricture. V. *Diseases of the urethra.* Inflammatory conditions: Gonorrhœa, Urethritis, Chancre and chancroid of the urethra. Urethral stricture, its varieties, causes, symptoms, and means of positive diagnosis. Urethral dilatation. Urethral rupture. Urethral deformities. Urethral tumors. Urethral abscess. Urethral fistulæ. Urethral spasm. Congestive stricture. Urethral calculi. Foreign bodies in the urethra. Symptoms of urethral rupture within the triangular ligament, perineal abscess, rupture of the urethra in front of its membranous portion, rupture in front of the peno-scrotal junction, Fracture of the penis, Organic stricture, and Urethral tumors. VI. *Diseases of the penis.* Diseases of the glans penis: Balanitis, Posthitis, Herpes progenitalis, Vegetations, Venereal sores, Epithelioma. Diseases of the prepuce: Phimosis, Paraphimosis; Diseases of the corpora cavernosa: Inflammation, Calcification, Gummy tumors, Chronic circumscribed inflammation, Fracture of the penis. Anomalies of the penis.

Differential diagnoses between chancroid and chancre, Herpes and balanitic abrasion.....Pages 255–332

PART VII. DISEASES OF THE ABDOMINAL CAVITY.

Injuries to the abdomen: Contusions, Wounds, Foreign bodies in the intestinal canal. *Diseases of the intestine:* Fæcal abscess, Intestinal obstruction, Hemorrhoids, Prolapse of the rectum, Fistulæ of the rectum, Fissure of the anus, Stricture of the rectum, Cancer of the rectum, Polypi of the rectum, Pruritus ani, Neuralgia of the rectum. *Hernia.* Classification of hernia. Nomenclature of hernia. Predisposing causes. Exciting causes. Symptoms of hernia in general. Congenital hernia. Ventral hernia. Diaphragmatic hernia, its causes, symptoms, and means of posi-

tive diagnosis. Table of diagnoses of inguinal hernia. Diagnoses of femoral hernia.

Differential diagnoses between typhilitis and perityphilitis, External hemorrhoids and internal hemorrhoids, External hemorrhoids and condylomata of anus, Internal hemorrhoids and rectal polypus, Rectal prolapse and rectal polypus, Cancer of rectum and stricture of rectum, Fissure of anus and fistulæ of rectum, Direct and indirect inguinal hernia, Scrotal hernia and sarcocele, Scrotal hernia and hydrocele, Scrotal hernia and varicocele, Scrotal hernia and hæmatocele, Incomplete inguinal hernia and bubo, Bubonocele and undescended testicle, Inguinal hernia and impaction of fæces, Inguinal hernia and hydrocele of the cord, Femoral hernia and enlarged glands, Femoral hernia and psoas abscess, Femoral hernia and varix of the saphenous vein, Femoral hernia and inguinal hernia, Femoral hernia and lipoma of the femoral canal, Ventral hernia and umbilical hernia, Thyroid hernia and perineal hernia, Diaphragmatic hernia and mediastinal tumors, Congenital hernia and hydrocele, Congenital hernia and infantile hernia... .....Pages 333-377

PART VIII. DISEASES OF TISSUES.

Inflammation, its derivation, definition, classification of its varieties, its predisposing causes, its exciting causes. A classified table showing the different results of inflammatory processes. The theories advanced to explain the various inflammatory phenomena. The variations in the rational symptoms of inflammation and the conditions which modify them. The constitutional effects of inflammation and the conditions which modify them. Special types of inflammatory processes. Catarrhal inflammation. Fibrous or Croupous inflammation. Inflammation of serous membranes. Inflammation of lymphatic structures. Inflammatory condition of tissue: Tumefaction, induration, suppuration, ulceration. Gangrene of tissues. Erysipelas. Elephantiasis. Lupus. Differential diagnoses between anthrax (carbuncle) and furuncle (boil), Abscess and circumscribed local œdema, Acute abscess and chronic abscess, Iliac abscess and abscess of the abdominal walls, Psoas abscess and femoral hernia, Abscess of the abdominal walls and enlargement of the spleen, Moist gangrene and dry gangrene, Cutaneous erysipelas and phlegmonous erysipelas. *Tumors.* Classification of solid tumors. Classification of cystic tumors. Tumors classified on a basis of location. Tumors of the brain, of the scalp, of the orbit, of the antrum, of the gums, of the lips, of the tongue, of the jaws, of the parotid gland, of the thyroid gland, of the lymphatics of the neck, of the integument of the neck, of the mammary gland, of the labia of the uterus, of the rectum, of the prostate, of the testicle. Tumors of special surgical regions. Tumors of the axilla. Tumors of the groin. Cancerous tumors. Differential diagnoses between benign and malignant tumors, Scirrhous and encephaloid cancer, Epithelioma and scirrhus, Colloid cancer and scirrhus of viscera, Cancer of axillary glands and tubercular diseases of axillary glands, Cancer of the omentum and enlarged spleen. Tumors of the head: Classification of. Differential diagnoses between sebaceous tumors of the scalp and fatty tumors of the scalp, Sebaceous tumors and exostoses of the cranium, Extra-cranial tumors and intra-cranial tumors, Encephalocele and dropsy of the brain, Encephalocele and cephalæmatoma, Abscess of the antrum and solid tumors of the antrum, Epithelioma and lupus. Tumors of the breast: Classification. Differential diagnoses between acute mammary abscess and chronic mammary abscess, Cysts of the breast and glandular tumors of the breast, Glandular tumor of the breast and hypertrophy of the mammæ, Scirrhus of the breast and innocent tumors of the breast. Tumors of the Uterus: Classification. Differential

diagnoses between congestive uterine hyperæmia and the early stages of pregnancy. Fibroid tumor of the uterus and pregnancy, Retained menstrual blood and pregnancy, Uterine hydatids and pregnancy, Uterine fibroid and a solid ovarian tumor. Uterine fibro-cyst and ovarian cyst, Uterine polypus and uterine fibroid. Tumors of the ovary: Classification. Differential diagnoses between ovarian dropsy and ascites, Fluid ovarian tumors and pelvic abscess, Unilocular ovarian cyst and venal cyst, Ovarian tumor and pregnancy. Tumors of the pelvis: Classification. Differential diagnoses between pelvic cellulitis and pelvic peritonitis, Pelvic hæmatocele and extra-uterine pregnancy, Vaginal polypus and inversion of the uterus, Pelvic hæmatocele and extra-uterine pregnancy. Tumors of the spine: Classification. Congenital tumors of the spine. Spina bifida. Differential diagnosis between spina bifida and congenital fatty tumor of the spine connected with the meninges.....Pages 378–457

PART IX. DISEASES OF THE BRAIN AND ITS ENVELOPES.

Table of the more important conditions. The chief symptoms of brain diseases. Congenital malformations of the Brain. Diseased conditions of the Cerebral vascular apparatus: Aneurismal dilatations; Atheroma, Spontaneous perforation, Cerebral thrombosis, Cerebral Embolism, Infarction. Inflammatory conditions of the Brain and its Envelopes: Pachymeningitis, Arachnitis, Hydrocephalus, Encephalitis. Degenerations of the Brain substance: Cerebral softening, white, red, and yellow; Sclerosis of the Brain, Cerebral atrophy. Tumors of the Brain and its Envelopes. Special symptoms indicative of Brain lesions. Motor paralysis: Cortical paralysis, from irritation and destructive lesions, Hemiplegia, Crossed paralysis, its various types, Complete paralysis, sensory paralysis: Affecting cranial nerves, Affecting spinal nerves, General symptoms, Hemianæsthesia, Numbness, Formication, Hyperæsthesia, Hemianopsia, Aphasia, its varieties and tests.

Practical, clinical, and physiological deductions concerning lesions of the Brain and the cranial nerves. Lesions of the Olfactory nerve: Anosmia and crossed paralysis. Lesions of the optic nerve: Amblyopia, Hemianopsia, Crossed paralysis, Choked disc, with hemianæsthesia, facial paralysis, hemiplegia, and aphasia. Lesions of the Motor oculi nerve: Ptosis, internal squint, crossed paralysis. Lesions of the fourth cranial nerve. Lesions of the Trigeminal nerve, axioms of diagnosis pertaining to them. Lesions of the Facial nerve: Axioms pertaining to the diagnosis of Facial paralysis. Lesions affecting the cranial nerves and nerve-tracts of the medulla oblongata: Duchenne's disease, Cheyne-Stokes respiration, general symptomotology. Lesions of the Cerebral cortex: Motor area of brain, monoplegia, early rigidity, pain, convulsions, aphasia. Lesions of the internal capsule of the Brain: hemiplegia, hemianæsthesia, impairment of special senses, choked disc, conjugate deviation of eyes, choreiform movements, rise in temperature, late rigidity of muscles. Lesions of the Optic Thalamus: Its four centres, Effects upon smell, Effects upon sight, Effects upon hearing, Effects upon general sensation, Effects upon hallucinations. Rules governing the use of the trephine. Differential diagnoses: Cortical paralysis and non-cortical paralysis, Irritative and destructive lesions of the cerebral cortex, Crossed paralysis of olfactory nerve and trigeminus nerve, Crossed paralysis of the motor oculi and the facial nerves, Bilateral facial paralysis, and Unilateral facial paralysis, Cerebral motor paralysis and Tabes dorsalis, Cerebral embolism and Cerebral thrombosis, Aphasia and Glosso-labio-laryngeal paralysis,

Cerebral softening and Cerebral abscess, Internal pachymeningitis and External pachymeningitis, Cerebral tumors and Cerebral softening, Cerebral hemiplegia and Spinal hemiplegia, Cerebral sclerosis and Paralysis agitans : Auditory vertigo and Epilepsy, Chronic hydrocephalus and Congenital hydrocephalus....Pages 461 to 539

PART X. DISEASES OF THE SPINAL CORD AND ITS ENVELOPES.

Table of the more important diseases of the spinal cord. Systematic lesions. Focal lesions. General axioms of spinal symptomotology. Physiological axioms pertaining to the spinal cord. Spinal paralysis, its varieties. Sensory phenomena due to spinal lesions. General symptomotology. Sclerosis of Türck's columns. Sclerosis of the lateral columns, its primary and secondary varieties. Myelitis of the Anterior Horns, Poliomyelitis of infants and adults, Infantile spinal paralysis, Acute spinal paralysis, Subacute poliomyelitis, Chronic poliomyelitis. Amyotrophic lateral sclerosis. Progressive muscular atrophy. Pseudo-hypertrophic paralysis. Central myelitis, Sclerosis of the posterior columns: Progressive locomotor ataxia, Tabes dorsalis, The pains, abnormalities of sensation, symptoms of incoördination, various complications, spinal reflexes, etc. : Focal lesions of the spinal cord, General symptomotology, The superficial spinal reflexes, The deep or tendon-spinal reflexes, Knee-jerk, ankle-jerk, foot-clonus, peroneal reflex, front-tap contraction, axioms of the clinical value of the spinal reflexes. Sensory phenomena in focal lesions, rigidity and spasm of muscles, bodily temperature and sweating, nutrition of the tissues, effects upon the special centres of the spinal cord, Guides to the different levels of the spinal cord. Focal lesions of the upper cervical region. Focal lesions of the cervical enlargement of the cord. Focal lesions of the mid-dorsal region of the cord. Focal lesions of the spinal cord above its lumbar enlargement. Focal lesions of the lumbar enlargement of the spinal cord. Focal lesions confined to one lateral half of the spinal cord. Spinal hemiplegia, Hemi-paraplegia, Differential diagnoses. Lateral spinal sclerosis, of cerebral and spinal origin ; Lateral sclerosis, primary and secondary; Poliomyelitis, acute and subacute; Poliomyelitis and Progressive muscular atrophy, Progressive muscular atrophy and Lesion of the ulnar nerve, Tetanoid paraplegia and Locomotor ataxia, Locomotor ataxia and the general paralysis of the Insane, Pseudo-hypertrophic paralysis and Locomotor ataxia, Paralysis agitans and Cerebro-spinal sclerosis, Organic paraplegia and Functional paraplegia, Myelitis and spinal meningitis, Spinal meningitis and Tetanus, Reflex paraplegia and Myelitis, General paralysis and Syphilitic general paralysis.....Pages 539 to 593

BIBLIOGRAPHY.....Pages 593–596

LIST OF ILLUSTRATIONS.

PLATE I.—Page 8. ORIGINAL SOURCE.

Varicose aneurism ..... *Chas. Bell*
Aneurism by anastomosis ..... *Erichsen*
Aneurism at elbow ..... *Hamilton*
Subclavian aneurism ..... "
Limits of pulsation in early stages of innominate aneurism ..... *Barwell*
Subclavian aneurism ..... "

PLATE II.—Page 14.

Aneurism of thorax ..... *Barwell*
Popliteal aneurism ..... "
Thoracic aneurism involving vertebræ ..... *Charing Cross Hospital Museum*

PLATE III.—Page 52.

Ostitis of knee with luxation ..... *Barwell*
Hydrarthrosis of knee ..... "
Arthritis of knee with ostitis ..... "
Knock-knee or genu-valgum ..... "
Housemaid's knee (double) ..... "
Arthritis of ankle ..... "
Enchondroma of phalanges ..... *Hamilton*

PLATE IV.—Page 60.

Caries and necrosis of tibia ..... *Barwell*
Bow-legs ..... "
Strumous arthritis of elbow ..... "
Spinal curvatures (four cuts) ..... *Hamilton*

PLATE V.—Page 74.

Strumous synovitis of knee ..... *Barwell*
Anchylosis of knee ..... "
Varieties of talipes (four cuts) ..... *Sayre and Hamilton*

PLATE VI.—Page 88.

Flat-foot ..... *Clarke*
Double talipes (two cuts) ..... *Sayre*
Arthritis deformans (two cuts) ..... *Canton*
Scrofulous synovitis of ankle ..... *Barwell*
Arthritis of wrist, with ostitis ..... "
Medio-tarsal deformity ..... *Sayre*

PLATE VII.—Page 102. ORIGINAL SOURCE.

Necrosis of skull-cap (two cuts)..... *Army Med. Museum*
Puncture of skull-cap..... " " "
Caries of vertebræ..... *Hamilton*
Articular disease following fracture..... *Barwell*
Caries of acetabulum and femur..... "

PLATE VIII.—Page 114.

Necrosis of skull..... *Army Med. Museum*
Malignant tumors of femur and tibia..... *Bennett*
Sequestrum..... *Hamilton*
Necrosis with osteo-myelitis..... "
Malacesteon (two cuts)..... "
Central necrosis, with an involucrum..... "

PLATE IX.—Page 134.

Osseous growths after fracture..... *Hamilton*
Osteophytes of femur..... "
Rachitic pelves (three cuts)..... "
Chronic rheumatic arthritis of hip-joint..... *Barwell*
Fracture of neck of femur with bony union..... *Hamilton*
Fracture of neck of femur with cartilaginous union..... "

PLATE X.—Page 140.

Sub-glenoid dislocation..... *Hamilton*
Sub-coracoid dislocation..... "
Dislocation of acromial end of clavicle..... "
Dislocation of sternal end of clavicle..... "
Sub-spinous dislocation of humerus..... "

PLATE XI.—Page 146.

Dislocation of clavicle..... *Andrews*
Dislocation of jaw..... *Hamilton*
Dislocations of humerus at shoulder..... "
Colles' fracture..... "
Dislocation of the phalanges..... "

PLATE XII.—Page 162.

Dislocations of carpus (two cuts)..... *Andrews*
Dislocation at elbow..... *Hamilton*
Dislocation at hip (two cuts)..... "
Dislocation at knee..... *Andrews*

PLATE XIII.—Page 174.

Attitudes of hip-joint disease (two cuts)..... *Barwell*
Dislocations of femur at the hip (three cuts)..... *Hamilton*

PLATE XIV.—Page 194.

Varieties of fracture of the skull (six cuts)..... *Army Med. Museum*
Hernia cerebri..... *Hamilton*

PLATE XV.—Page 220. ORIGINAL SOURCE.

Fractures at shoulder (two cuts)..... *Hamilton and Gray*
Fractures at elbow (two cuts)..... *Hamilton*
Fractures in region of ankle (two cuts)..... *Andrews*

PLATE XVI.—Page 268.

Enlarged lobe of prostate gland..... *Hamilton*
Stone in the bladder (three cuts)..... *Coulson*
Rectal fistulæ (three cuts)..... *Mollière and Gosselin*

PLATE XVII.—Page 292.

Urethral stricture (five cuts)..... *Gouley*
Hypertrophy of bladder..... *Coulson*
Medullary tumor of bladder..... "
Sounding for stone in the bladder..... *Hamilton*

PLATE XVIII.—Page 338.

Rectal polypi (two cuts)..... *Esmarch*
Prolapse of rectum..... *Mollière*
Internal hemorrhoids..... *Hamilton*

PLATE XIX.—Page 348.

Hernia (four cuts)..... *Hamilton*
Spina bifida..... "

PLATE XX.—Page 392.

Gangrene..... *Bennett*
Contents of a sebaceous cyst..... "
Microscopical appearance of tumors (six cuts)..... "

PLATE XXI.—Page 468.

Diagram of the subdivisions of the motor area of the brain..... *Ranney*

PLATE XXII.—Page 478.

Diagram of the centres of the convolutions of the brain of man..... *Modified slightly from Ferrier*
Diagram of a spinal segment, showing its subdivisions and the construction of each spinal nerve..... *Ranney*

PLATE XXIII.—Page 482.

Diagram explicative of hemiopia..... *Seguin*
Diagrammatic representation of the skin-symptoms produced by a unilateral lesion of the spinal cord..... *Erb*
Disease of the anterior horns of the spinal gray matter..... *Roth*

PLATE XXIV.—Page 486. ORIGINAL SOURCE.

Diagram of the course of fibres within the nerve of sight..... *Ranney*
Diagram to show the relations of the nerve of sight to adjacent structures within the cavity of the skull..... "

PLATE XXV.—Page 496.

Diagram to show the course of nerve fibres within the substance of the brain..... *Ranney*
Diagram to show the important structures situated at the base of the brain..... "

PLATE XXVI.—Page 540.

Diagram showing the effects of a transverse myelitis..... *Erb*
Diagram showing multiple sclerosis of the spinal cord..... "
Diagram showing changes in the spinal cord in locomotor ataxia..... "
Diagram showing secondary descending degeneration of the spinal cord..... "

PLATE XXVII.—Page 544.

Diagram of the nerve-tracts of the medulla..... *Erb*
Diagram of the nuclei within the substance of the medulla..... "
Diagram of the physiological subdivisions of the spinal cord in man..... *Ranney*

PLATE XXVIII.—Page 548.

Diagram of the course of the principal tracts of nerves within the spinal cord..... *Erb*
Diagram of the decussation of the motor fibres within the substance of the medulla..... "
Diagram of the sensory tracts of the spinal cord..... "

PLATE XXIX.—Page 552.

Bell's paralysis..... *Ranney*
Attitude of hand in paralysis..... *Rosenthal*
Progressive muscular atrophy..... "
Cross-legged progression..... *Med. Record*

PLATE XXX.—Page 556.

Attitudes assumed in pseudo-hypertrophic paralysis..... *Duchenne*
Infantile paralysis..... *Unknown*

PLATE XXXI.—Page 560.

Pseudo-hypertrophic paralysis confined to calves alone..... *Duchenne*
Pseudo-hypertrophic paralysis affecting legs but not the trunk.. "
Erect attitude of spinal caries..... *Agnew*
Stooping attitude of spinal caries..... "

DISEASES OF THE BLOOD-VESSELS.

DISEASES OF THE BLOOD-VESSELS.

The DISEASES OF THE ARTERIES to which surgical attention is most frequently directed, are of two classes:

A. DISEASES OF THE ARTERIAL COATS, under which will be considered:

1. Atheroma.
2. Fatty Degeneration of the Arterial Coats.

B. DISEASES AFFECTING THE CALIBRE OF VESSELS, comprising:

1. Aneurism.
2. Occlusion of Arteries from Pressure.
3. " " " " Emboli.
4. " " " " Thrombi.
5. " " " " Foreign Bodies.

The DISEASES OF THE VEINS encountered in a surgical practice are:

1. Hypertrophy of the Venous Coats.
2. Atrophy " " " "
3. Degeneration " " " "
4. Adhesive Inflammation—"Adhesive Phlebitis."
5. Suppurative " —"Diffuse Phlebitis."
6. Varicose Tumors of Veins.
7. Obstruction to Veins from Emboli, Thrombi, and outside pressure.
8. Parasites of Veins.

The points of interest which bear upon the diagnosis of each of these conditions will be first separately reviewed, since a tabular form of statement often fails to meet the demands of the student or the practitioner.

In the closing pages of this chapter, however, will be found the

points of *special diagnostic value contrasted*, to further assist memory and to facilitate reference.

A.

DISEASES OF THE ARTERIAL COATS.

ATHEROMA.

This condition may be produced by age, chronic alcoholism, gout, rheumatism, lead poisoning, syphilis, chronic diseases of the kidney, exposure, or traumatism. It is a direct result of an existing chronic endarteritis, the lining membrane of the vessels being invariably involved to a greater or less degree. It is most frequently found in the arteries, although the veins may develop an atheromatous condition when exposed to any source of prolonged irritation. It is also developed in the male sex in far greater proportion than in females; and is apparently influenced to some extent by climate.

As a result of this condition, the affected vessel becomes impaired in its contractile power, loses its natural tone, and, in consequence of its inability to sustain its accustomed internal pressure, undergoes, in many cases, dilatation at the seat of the disease. When the condition of atheroma is once developed, rings of ossification are often perceptible along the course of the affected vessel, if it be superficially situated; and an abnormal tortuosity of the artery is not infrequently present, if the atheromatous condition is diffused for some distance along the vessel.

The existence of atheromatous changes is not always to be detected, however, by the sense of touch. *Diminished arterial volume*, and an *impaired nutrition* to tissues when an excessive arterial supply is demanded (as occurs in inflammatory processes), are frequently points of value in the diagnosis of an atheromatous condition of the vessels. Atheroma has especial surgical importance from a tendency which exists towards rupture of the affected vessels, either from an ulcerative destruction of their coats, or from the rigid and brittle condition of the walls of the vessel, produced by the calcareous deposits. In cases demanding the application of a ligature to a vessel having pronounced atheromatous changes within its walls, the danger of secondary hemorrhage is greatly increased; and the application of the ligature itself is not infrequently rendered difficult by the breaking of the vessel.

Atheroma is most frequently developed at that bulging of the

aorta known as the Sinus Magnus, which is situated near the point of junction of the ascending and transverse arch; and it affects, next in frequency, the innominate artery and the left carotid artery. The excessive strain borne by these vessels, in resisting the direct pressure of the heart, may possibly be considered as a mechanical excitant in producing the disease most frequently in these localities. No part of the circulatory system can, however, be considered as exempt from atheromatous changes.

The extent to which atheroma affects the blood-vessels admits of large variation. In some instances, every vessel named by anatomists is thus diseased, while, in others, only certain vessels, and even parts of vessels, are found to be affected. In extensively developed atheroma, a symmetrical condition is usually present on the two sides. This point may in some cases be of importance, since a guide to diagnosis may be thus afforded. Cases, which have often been reported, of parallel and contemporaneous popliteal aneurisms in the same person, illustrate well the tendency towards a symmetrical development of atheroma.

Atheroma develops more often in the lower limbs than in the upper, and the extent of its progress seems to be greater when situated below the diaphragm than when above it.

The dangers which result from ligation of a vessel which has undergone atheromatous changes within its coats, render the detection of these changes important, even if the disease be unassociated with marked external evidences of its existence previous to the vessel being exposed.

The process of repair cannot be perfected in an artery whose lining membrane is tough or osseous, or in a state of fatty degeneration, whose middle coat has atrophied, and whose contractility, now destroyed, admits of no diminution in its calibre between the ligature and the next branch.

FATTY DEGENERATION OF VESSELS.

This condition of the vascular system may exist either as a primary affection, or it may develop secondarily as a result of some previously existing condition.

If it exists as a *primary disease*, it is usually detected in the aged, and is an indication of a general impairment in activity. When other tissues of the body are similarly affected, it may be reasonably conjectured that the blood-vessels have, to a greater or less extent, participated in the fatty degenerative process.

This condition of the vessels may occur, however, at younger periods of life; but, if so, it is generally a *secondary* and not a primary disease. It frequently exists in connection with atheromatous changes, and, in this case, is probably the result of an increased nutritive activity in the affected parts.

In the condition of fatty degeneration, no spots of ossification can be detected in the affected vessel, unless a complicating atheroma exists; nor does the tendency to easy rupture, which is so markedly present in atheroma, manifest itself to any serious extent. The application of stimulation or cold to the affected parts will often, however, reveal a condition of *defective contractility* in the vessels affected with fatty degeneration of their walls; and a dilated and tortuous condition of the vessels may occasionally be detected. When the superficial arteries, as the temporal or radial, exhibit a defective contractility, so that, in spite of the influences of external agents, such as cold, the rigors of fever, etc., etc., they present but trifling variations in their calibre, and appear soft and of uniform size, we may reasonably suspect the existence of fatty degeneration of the vascular system, especially if age has brought with it a failure in energy of the heart and the muscular system in general.

Fatty degeneration of vessels is most common in the aorta, but it may affect any one, or even all of the blood-vessels.

Occasionally, from the diminished calibre of the affected vessels, and from defective heart power, symptoms of disturbed circulation will exist, especially in the fingers and in the toes, if the condition be extensively developed.

Patients in this condition suffer from a subjective feeling of cold, and often an actual diminution in temperature; and sensations of numbness and of formication are not infrequently present. Trifling injuries such as a moderate exposure to cold, may, in these cases, lead to inflammation and subsequent death of the part. In other cases, gangrene and mummifying of a part, apparently without any cause, may occur; and nature may mark out, as a result of such a change, an inflammatory line of demarcation.

Spontaneous gangrene, œdema, and varicose veins are not infrequent results of some form of disease affecting the coats of the blood-vessels; and should they appear, when both sides of the body present a like condition, the possibility of an embolus or a thrombus as an exciting cause can be safely excluded, and an abnormal condition of the general vascular coats be safely diagnosed.

B.

DISEASES AFFECTING THE CALIBRE OF VESSELS.

ANEURISM.

By *Aneurism* is meant a tumor containing blood, and communicating with the calibre of an artery.

Aneurism may be classified from two distinct standpoints:

1st. On a *pathological* basis, having reference to the construction of the sac of the tumor.

2d. On a basis of the *anatomical* location at which the tumor is developed.

On the first basis, Aneurism may be divided into two great varieties, dependent upon the condition of the arterial coats; under each of which may be grouped those various types of Aneurism to which a special nomenclature has been applied.

The following table will explain itself:

- **Aneurism classified on a *pathological* basis. 2 great types.**
  - A. Where all the coats of the vessel are intact. 5 varieties.
    - Fusiform Aneurism, where all the arterial coats are equally dilated throughout the entire circumference of the vessel.
    - True Aneurism, where all the arterial coats are dilated at one spot in the circumference of the vessel.
    - Nævus, where the capillary vessels are abnormally dilated, and extensive anastomosis exists.
    - Arterial Varix, where a single vessel is uniformly dilated for some distance along its course.
    - Cirsoid Aneurism, where a collection of dilated and tortuous vessels exists.
  - B. Where one or more of the arterial coats is ruptured. 6 varieties.
    - Hernial Aneurism, where a protrusion of the coats occurs through the external coat.
    - Dissecting Aneurism, where a separation of the arterial coats by blood exists.
    - Diffuse Aneurism, where an escape of blood from the artery into surrounding tissues occurs.
    - Varicose Aneurism, where an indirect communication between an artery and a vein exists through an intervening sac.
    - Aneurismal Varix, where a direct communication between an artery and a vein exists.
    - False Aneurism, where one coat only of the artery remains as a sac for the tumor

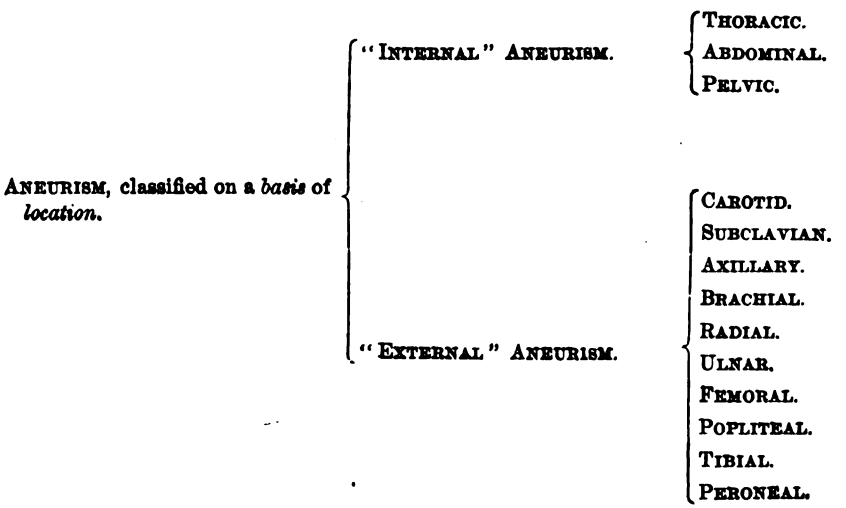
By most authors Aneurism has been differently classified, and separate divisions have been made by some to include distinctive anatomical types.

Thus, the term "*Encysted*," or "*Common Aneurism*," includes, in many classifications, the following varieties:

True Aneurism.
False "
Diffuse "
Fusiform "
Dissecting "

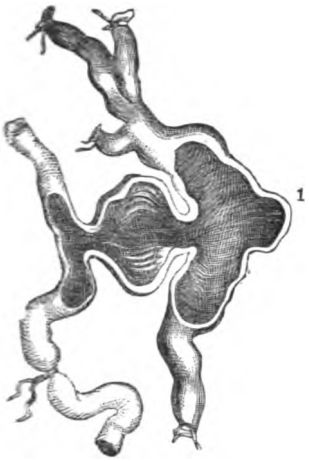
Again, the term "*Arterio-venous Aneurism*" is used by some authors to include both "Aneurismal Varix" and "Varicose Aneurism," while to the "Diffuse" type of Aneurism the term "*Cystogenic*" was applied by Broca, and is still frequently employed.

Aneurism may be classified, in the second place, on the basis of its *anatomical location*, as follows:



By this classification the surgeon is enabled to designate and describe the aneurismal tumor before its exact pathological condition is determined, should such be capable of diagnosis during the life of the patient.

PLATE I.



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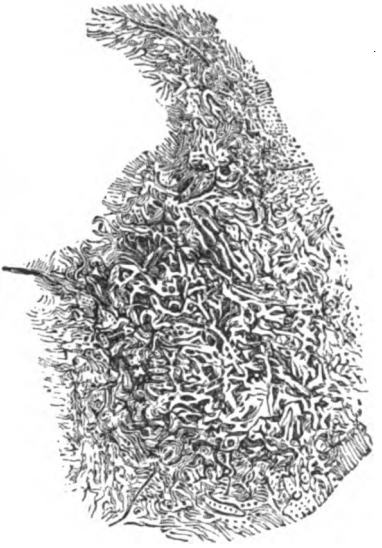

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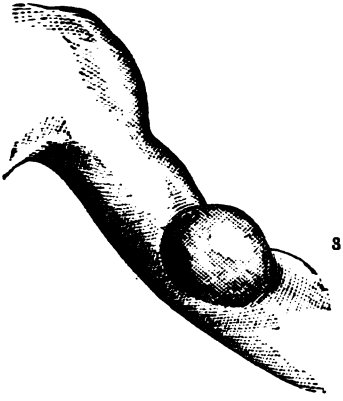

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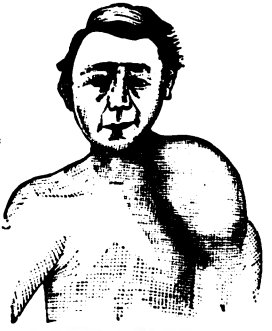

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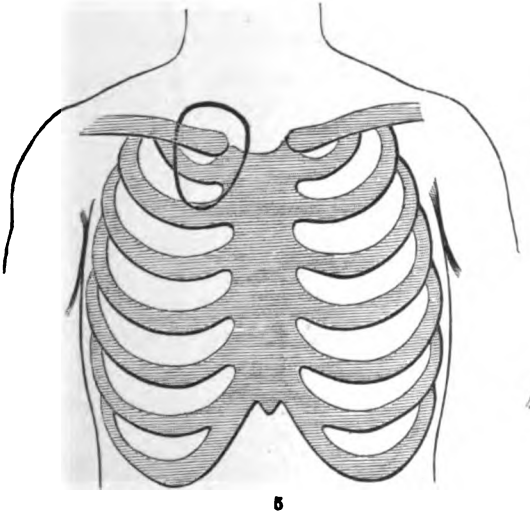

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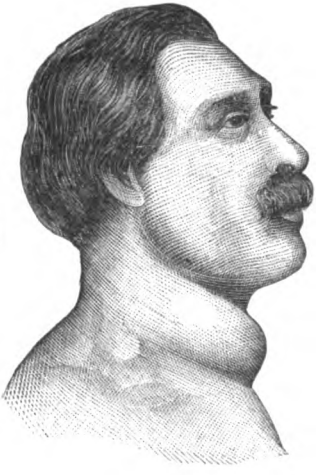

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1. Varicose aneurism. 2. Aneurism by anastomosis. 3. Aneurism at elbow. 4. Subclavian aneurism of large size. 5. Usual limits of pulsation of innominate aneurism. 6. Subclavian aneurism.

Causes of Aneurism.

The causes of aneurism may be divided into the predisposing and the exciting.

Under the first (the *predisposing* causes) may be mentioned the following conditions, which are not infrequently conducive to the development of aneurismal tumors:

(1.) Atheromatous degeneration of the arterial coats.
(2.) Fatty degeneration of the arteries.
(3.) Exposure of a normally deep-seated vessel (thus creating an absence of the proper support).
(4.) Weakening of the arterial coats, from long-continued pressure.
(5.) Old age. (Probably by producing a fatty degeneration of the arteries.)
(6.) Sex. (Women are seldom affected with external aneurisms.)
(7.) Syphilis.
(8.) Mercurial poisoning.
(9.) Climate. (Frequent in cold climates, or in those where sudden changes occur; rare in Germany and Italy.)
(10.) Chronic alcoholism.
(11.) Paralytic relaxation of the arterial coats (from paralysis of the vaso-motor nerves).

Under the second (the *exciting* causes) may be mentioned:

(1.) Excessive strain to vessels in certain anatomical situations. This is illustrated in the aortic arch, in vessels near to joints, at the bifurcations of vessels, at the cœliac axis, etc.
(2.) Cardiac Hypertrophy. (By increasing the arterial pressure.)
(3.) "Aneurismal Diathesis." (Some anatomical defect in the arterial coats is usually present.)
(4.) Laborious occupations. (By the tendency towards undue strain, excessive exertion, etc.)
(5.) Violent mental emotions.
(6.) Impaction of an embolus in a diseased artery (the artery dilating above it).
(7.) Suppuration over a deep-seated vessel.
(8.) Direct injury to a vessel from falls, blows, severe concussions, etc. (Traumatic Aneurism.)

Situation of Aneurismal Tumors.

Aneurismal tumors are confined to no special localities of the body. They are most frequent in the arch of the aorta; next in frequency in the arteria innominata and the left carotid artery. They are especially common in the axillary, popliteal, femoral, and iliac arteries, and in the cœliac axis.

Growth of Aneurismal Tumors.

Aneurismal tumors grow either by compression of the surrounding tissues, provided these tissues are elastic, or by absorption of cartilaginous or bony investments. The rapidity of the growth depends therefore somewhat upon the character of the tissues which surround the artery, and also upon the *position* and the *size* of the point of communication of the tumor with the artery, and the *direction* of that opening in its relation to the blood-current. Should the opening be small, and so directed as to favor the passage of blood *by*, rather than *through*, the opening of the aneurismal tumor, the development would naturally be greatly retarded by such a condition, irrespective of the character of the tissues which might invest the sac.

We notice, therefore, great variations in the rapidity of growth of aneurismal tumors; and, in some cases, symptoms to come may be predicted with tolerable precision by a careful study of the situation and configuration of the sac.

Symptoms of Aneurismal Tumors in General.

Aneurisms vary, in the symptoms produced, with the locality affected. Most of the symptoms are the result of pressure of the tumor upon either organs, nerves, muscles, bone, or joints, and must vary with the anatomical and surgical relations of the larger vessels. There are, however, certain definite and *pathognomonic signs* of aneurismal tumors, which are *not all* attainable in the arteries of the trunk, but which are most reliable and of the greatest value in external aneurisms of the head, neck, and extremities. These symptoms may be thus enumerated.

(1.) *Diffusible or Expansive Pulsation.*—This term is used to designate the expansion of an aneurismal sac during the arterial throb, in contrast to the simple rising and falling pulsation which exists in any solid tumor when placed in close contact with a large vessel.

The former indicates a transmission of the throb from the *centre* of the tumor in *every* direction; the latter the transmission of a force *external* to the tumor and in *one* direction only.

Pulsation in aneurismal sacs cannot always be easily perceived, and may occasionally be lost. It is diminished in its force—1st, by large deposits of laminated fibrin or blood coagula in the interior of the aneurismal sac; 2d, by the depth of the tumor from the surface; 3d, by the size of the tumor; 4th, by the character of the surrounding tissues; and 5th, by the condition of the supplying artery and the force of the heart. It is a custom with some surgeons in examining a tumor, where, with the hand softly grasping the growth, the pulsation is indistinct or absent, to place upon the tumor a small fleck of white paper, and, with the tumor between the vision and the light, to watch carefully for any movement which the paper may indicate. By this means pulsation has frequently been detected, when the eye and hand had previously yielded negative results.

(2.) *Bruit.*—By this term is designated a *peculiar noise* heard over the aneurismal sac, and created by the rush of the blood-current through its interior cavity. This "bruit" is usually single, and is always synchronous with the heart's action. In large vessels, it is occasionally a double sound. It is present over an aneurismal tumor in *all possible positions* both of the tumor and of the body, and in this respect differs from any sound transmitted, through a solid tumor or an organ, from a vessel to which it is not firmly attached. This bruit is usually of a rough and harsh character, and is *most intense* over the seat of the aneurism, although, in some conditions, this sound may be transmitted through the surrounding tissues for a considerable distance.

(3.) *Diminution of the Tumor in size on direct pressure.*—Aneurismal tumors, when gently pressed upon, gradually yield to the pressure applied, and decrease in volume as the blood is forced from the interior cavity into the arteries. This subsidence is, however, but temporary if the force be removed, as the sac soon refills, after sufficient time has elapsed for two or three beats of the heart to again propel sufficient blood into the cavity of the aneurism.

This subsidence under pressure may occasionally be simulated by the displacement of a solid tumor from its immediate relation to an artery, which had previously given to it a pulsating movement. But, in this case, the tumor often *loses its pulsation* for an appreciable time after the pressure has been removed, or it may even require

some movement of the body to restore it to its former relation with the artery. A point of great diagnostic value is often thus offered, and the question of the existence of an aneurism is in such a case easily settled.

(4.) *Decrease in size of the Tumor by pressure on the proximal side of the supplying vessel.*—This test is of great diagnostic value, but is not always capable of being satisfactorily applied. It requires, for its complete performance, that the artery be so compressed that the pulsation shall be either entirely or largely controlled, and that the quantity of blood received by the tumor shall be greatly reduced in amount. If the tumor be reduced in size to a *marked degree*, by thus controlling the flow within the vessel, the diagnosis of aneurism is positive.

(5.) *Increase in the size of the Tumor by pressure on the distal side of the supplying vessel.*—This test, like the preceding one, it is not always possible to apply. Its success depends not alone on reaching and compressing the distal side of the vessel, but also upon the character of the sac and of the surrounding tissues.

It is not always a *safe procedure*, in case danger to the sac from over-distention be anticipated, or rupture appears imminent.

Symptoms of Thoracic Aneurism.

The *ascending portion of the arch of the aorta*, being enclosed within the pericardium, and being also the most frequently affected with aneurismal disease of any vessel in the arterial system, presents symptoms not in common with aneurismal sacs in other situations, and which allow of an explanation on a purely anatomical basis.

If the *aneurismal sac be situated low down*, in the region of the aortic sinuses, the right coronary sinus in the heart becomes pressed upon early, from enlargement of the tumor in the anterior direction, since the regurgitation of blood produces the greatest pressure upon that aspect of the vessel, and the *nutrition of the heart* may thus be interfered with. In the more *advanced stages* of development, however, the tumor may, by pressure, impede either the current in the pulmonary artery, or in the superior vena cava; or possibly interfere with the free action of the right auricle, or even of the right ventricle. Thus cyanosis, distended jugulars, a bruit in the pulmonary artery on auscultation, or irregular heart's action may ensue.

If the *aneurism of the ascending arch* be *higher up*, as is most common, the tumor develops, as a rule, to the right of the median line, and, when of large size, tends to approach the anterior aspect of the thorax. We frequently, therefore, find the sternum and the ribs of the right side undergoing rapid absorption, and a pulsating tumor develops in the locality of the manubrium. By pressure of the tumor upon the neighboring parts, symptoms of apparent disease in the right lung, and those referable to impairment of the trachea, main bronchi, or œsophagus, may also simultaneously develop.

Aneurism of the transverse portion of the arch of the aorta most frequently develops at its right extremity, and the posterior aspect of the vessel. At this point many important relations exist, which render the development of a tumor an inevitable associate of symptoms referred to other localities.

The trachea, œsophagus, and thoracic duct lie in the closest relation posteriorly; the recurrent laryngeal nerve winds around the aorta on the left side; and the large arterial trunks given off from its convex or upper border furnish the blood-supply to the head and the upper extremities.

For this reason the pressure of an aneurismal tumor in this locality, by *affecting the bronchi* or the *trachea*, may produce dyspnœa, cough, hæmoptysis, and stridulous respiration; by affecting the *œsophagus*, deglutition may be impaired or destroyed; by creating pressure on the *thoracic duct*, the patient may die of inanition.

Pressure upon the recurrent laryngeal nerve has often produced symptoms so analogous to those of inflammation of the larynx, that tracheotomy has often been performed from an error in diagnosis.

By an *obstruction of the innominate artery*, either partial or complete, the radial pulse of the right side may be either diminished in its volume or entirely absent.

By *pressure upon the innominate veins* the venous return from the head and upper extremities may be impaired; and thus cyanosis, œdema, and diminished temperature of the parts in which the circulation is obstructed, may result. When an aneurismal dilatation of the arch of the aorta develops to a great size in an *upward* direction, it may simulate aneurism of the arteria innominata, by appearing above and to the right of the sternum; and by reaching the brachial plexus of nerves in the neck, it may produce shooting pains running down the upper extremity to the tips of the fingers.

Aneurism of the descending portion of the arch of the aorta is usually situated upon the left side of the vessel, and develops in a backward direction. By pressure, it most frequently causes absorption of the

adjoining ribs and bodies of the vertebræ. It may, however, produce also symptoms referable to pressure upon the trachea, left bronchus, œsophagus, and of the right and left lung. In case of spontaneous rupture of the sac, the blood may be poured out into the pleural cavity (usually that of the left side); or, in rare cases, into the trachea, left bronchus, œsophagus, or into the substance of the left lung. In this variety of aneurism, an *intercostal neuralgia* of a severe and constant type is produced by pressure of the growing tumor upon the intercostal nerves which lie between it and the ribs.

DIFFERENTIAL DIAGNOSIS.

The diagnosis of aneurism as a disease is often difficult, and a discrimination between its types is frequently impossible.

A. It may be confounded as a *disease* with—

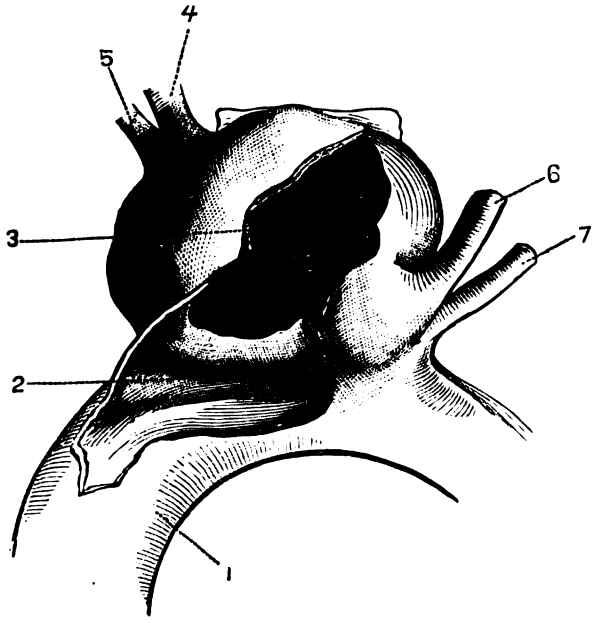
1. A tumor lying upon some large vessel.
2. Erectile tumors.
3. Pulsation of a relaxed aorta.
4. An abscess over some large vessel.
5. Abdominal tumors.
6. Some types of painful abdominal disease.
7. Solid obscure tumors.
8. Intra-thoracic tumors.
9. Tubercular consolidation at apex of lung, complicated with an arterial murmur.
10. Psoas abscess.
11. Cancer of bone.
12. Pulsatile tumors of bone.
13. Encephaloid cancer.

B. The different *types* of aneurism may also be confounded with each other when diagnosis is possible during life.

C. The *seat* of aneurismal tumors, especially those of the *internal* type, is to be differentiated by variations in the rational and physical signs pertaining to the various localities in which the tumor may be situated.

In subsequent pages of this volume will be found enumerated the various points of differential diagnosis of aneurism from those diseases liable to be confounded with it; and also tables to assist in the discrimination between its various types.

PLATE II.



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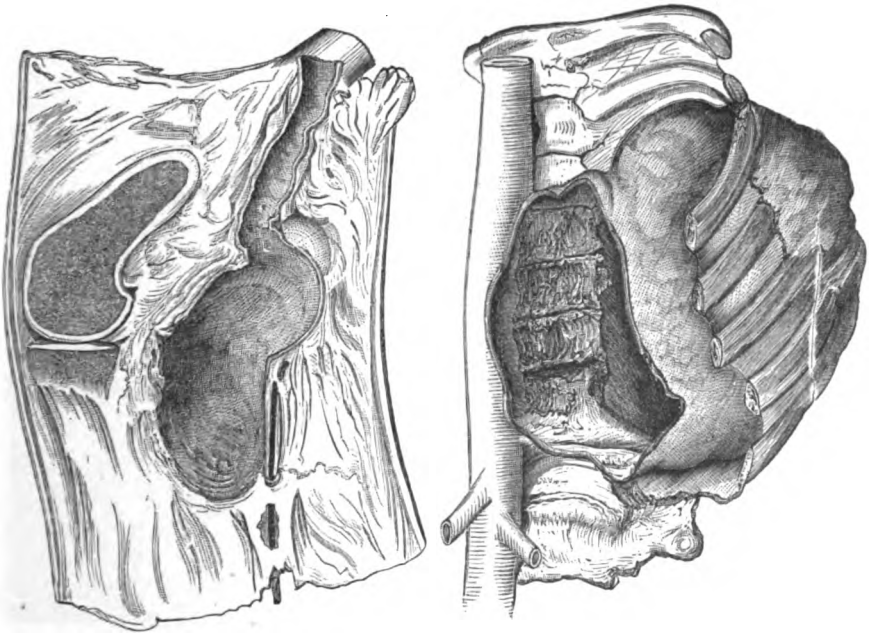

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1. Aneurism of innominate, arch of aorta, and left carotid. (1, Arch of aorta; 2, Laminated fibrin from interior of aneurism; 3, Cavity of aneurism; 4, Right carotid; 5, Right subclavian; 6, Left carotid; 7, Left subclavian.) 2. Popliteal aneurism causing deformity of knee. 3. Aneurism of the thorax causing caries of the vertebræ.

OCCLUSION OF ARTERIES.

The calibre of arteries may be occluded by pressure, emboli, thrombosis, and foreign bodies.

In certain positions of the trunk, the blood-current may often be temporarily arrested from the first-mentioned cause, provided the artery be so placed as to perceive the pressure created. This may occur, in the radial and ulnar arteries, on flexion of the elbow; in the tibial or popliteal, on flexion of the knee; and, occasionally, in the subclavian, through a compression exerted by a depressed clavicle or during forced expiratory efforts, the artery, in this case, being situated above its normal position.

Pressure upon arteries from *fragments of bone* often produces partial or complete occlusion of some vessel, which may disappear after a proper adjustment of the fragments is effected.

Osseous tumors may occlude vessels and produce marked effects on the tissues supplied by the vessels compressed. Thus exostoses of the femur not infrequently impair the femoral, and bony tumors from the rib, the subclavian artery. *Cancerous* and occasionally *benign tumors* may involve and destroy arterial trunks, and thus gangrene is sometimes produced.

It is rare, however, for gangrene to follow the obliteration of arteries from the pressure of growing tumors upon them, since the compression is too gradual to cause a complete and sudden cessation of nutritive supply to the parts to which the vessel is distributed.

Vessels may, in the second place, be occluded by *embolism.*

By the term *emboli*, we mean all movable bodies in the circulation formed at a spot more or less distant from the seat of lodgement within the vessel.

Among the various forms of emboli detected may be mentioned, 1st, vegetations of fibrin, detached from the valves of the heart; 2d, blood coagula, usually the result of mechanical or inflammatory stasis; and 3d, broken-down fragments of morbid growths which have been swept into the circulation.

Emboli are *usually found within the arterial system.* The most frequent seat of embolic obstruction is the left middle cerebral artery, since this artery affords the most direct channel for blood propelled from the left heart; but the various organs of the body are also not infrequently affected.

Embolism results in either a partial or complete obstruction to the normal current in the vessel occluded. If the obstruction to the direct circulation is complete, and the collateral circulation is imper-

fectly performed, gangrene of the parts supplied becomes inevitable. If, however, the obstruction to the vessel be incomplete, or the collateral circulation of the part be sufficient to sustain its nutrition, the foreign particle may create but a temporary interference with the normal functions of the part affected, and may, possibly, be eventually removed by fatty degeneration, if the embolus be of organic origin.

Organs with a single arterial trunk, as the retina, testicle, or spleen, may be entirely deprived of their function by the entrance of an embolus into the mouth of the supplying vessel.

In very young subjects, complete obstruction of even large vessels is seldom followed by gangrene. Cases are on record of the obliteration of the aorta in an infant without mortification ensuing; while, in a case reported by Savory, complete obliteration of all the main arteries of the extremities, and of the left side of the neck existed (probably a congenital malformation) without the appearance of gangrene in any part.

The occlusion of arteries by *thrombosis* is not, however, to be confounded with embolism, since a *thrombus* signifies the existence of *coagulated blood formed at the seat of obstruction.* It can thus be understood, by a definition of the terms, that a disintegrated thrombus may result in embolism, and that thrombosis may follow embolic obstruction, without the two being identical.

Thrombosis of vessels may follow any condition which impairs the calibre of the vessel, alters its anatomical construction, or interferes with its blood-supply. It may follow diseases of the vessel or the surrounding structures; pressure upon the vessel; injuries to the vessel; enfeebled heart's action; valvular disease of the heart; impaired venous return from any cause; and finally pyæmic poisoning.

The clot, so formed, may become adherent to the coats of the occluded artery, and organize, in which case the vessel becomes permanently obliterated; or it may disintegrate by a process of suppuration, and the particles so detached may be swept into the blood-current and become emboli.

Pyæmia, when occurring with the existence of open wounds, seems to manifest the presence of its peculiar miasm within the blood of the infected by a marked tendency towards *spontaneous coagulation* of the blood in the capillary vessels, where the rapidity of the blood-current reaches its lowest point. It is to this fact that some authors endeavor to explain the *simultaneous appearance* of secondary abscesses in many portions of the body, since these thrombi, being the result of pyæmic poisoning, act as generating centres for suppurative inflammation.

DISEASES OF THE VEINS.

The diseases of the veins encountered in a surgical practice have been already enumerated, and will now be separately considered.

HYPERTROPHY OF THE VENOUS COATS.

This condition is usually associated with an increased size of the vein. It is a natural and healthy provision of nature to afford enlarged channels for an excessive venous return. Thus in pregnancy, the uterus is provided with abnormally large venous channels, to allow of the removal of the excess of blood from that organ; in cancer of the omentum, the portal vein is frequently enlarged to nearly double its normal size; in cases of obliteration of veins from any cause, the neighboring veins usually undergo compensatory hypertrophy of their coats as their calibre is increased. Finally, hypertrophy of veins occurs often in connection with chronic inflammatory processes.

This hypertrophied condition may be either transient or permanent as the exigencies of the case demand, and has no great surgical interest save as a help to the diagnosis of other conditions.

ATROPHY OF VEINS.

This condition is a natural consequence of disuse. The veins of limbs undergo atrophy after amputation till their size corresponds to the amount of blood which is returned from the part. After the removal of organs, as the testicle, penis, etc., or in extensive cystic degeneration of glands dependent on the occlusion of the excretory duct, the veins rapidly diminish in their calibre. Persistent external pressure also often leads to atrophy of the veins, whose current is thus impaired or arrested.

DEGENERATION OF THE VENOUS COATS.

The venous coats are less subject to degeneration processes than the arterial coats.

Fatty degeneration of veins is somewhat rare, but *calcification* is more common. In this latter condition, osseous plates or rings are found imbedded in the venous coats, and the veins of the lower extremity are most frequently so affected.

Calcification of veins seldom occurs without a previous dilatation of the vein.

Amyloid degeneration seldom affects the superficial veins of the body, and its diagnosis is therefore not usually possible during life. It occurs in extensive amyloid degeneration of organs, and usually is most apparent in the large systemic trunks and in the portal vein. It may affect the entire thickness of the venous coats, or only the middle and internal coats.

Practically, therefore, the surgeon is called upon to recognize during life only hypertrophy, atrophy, and calcification of veins. These three alter the resistance of the tube as perceived by the touch, and also affect the extensibility of the vein in its relation to the amount of blood pressure.

Cancerous degeneration of veins is more common than that of the arterial trunks. It is almost always secondary to a similar condition of neighboring tissues. It may penetrate the vein and produce thrombosis, or particles of the cancerous mass may escape into the circulation and produce embolism of vessels at a point remote from the seat of disease.

The symptoms and results of carcinoma of the veins differ in no respect from those of thrombosis.

ADHESIVE INFLAMMATION OF VEINS. (*Adhesive Phlebitis, Thromballosis.*)

This condition is primarily a disease of the venous coats. It is usually circumscribed in character, and may occasionally occur in a condition of otherwise perfect health. It may follow injuries to venous trunks, pressure on venous trunks, ligation of veins, amputations, or abnormal blood conditions which predispose to irritation.

It is associated with local pain and tenderness along the course of the inflamed vein, with possibly some constitutional disturbance, with œdema which is often well marked and whose severity depends upon the amount of obstruction to the free circulation in the affected vein, and with prominence of the neighboring veins which are obliged to carry abnormal amounts of blood, if the inflamed vein fails to perform its proper function.

It is not usually associated with pyæmic symptoms, since the coagula formed within the vein at the seat of inflammation do not usually disintegrate through subsequent suppuration.

In adhesive phlebitis, complete and permanent obliteration of the vein is by no means uncommon. The affected vein, if entirely obliterated, becomes a shrunken, firm, and sometimes a calcareous cord. In fractures, the œdema from a local phlebitis produced by

the injury may often greatly impair union, and in some cases greatly interfere with the circulation of the injured part.

If the *deep veins* of a limb are affected with adhesive phlebitis, the *superficial veins* will often show *marked increase in size* before the œdema is apparent; the limbs will feel hot and dry, and will usually be maintained in a flexed position. Extension of the limb will often produce considerable pain, and a well-marked constitutional disturbance will occasionally exist. If the *superficial veins* be affected, they can usually be felt as hard cords under the finger, the induration being due either to the formation of clots within the vein, or to thickening of the surrounding tissues, or, more often, to the two conjointly. An accompanying redness and tenderness will usually mark the seat and extent of the inflammatory process.

SUPPURATIVE PHLEBITIS. (*Diffuse Phlebitis.*)

This condition is properly a variety of diffuse phlegmonous inflammation. It *never occurs in patients with robust health*, and requires some exciting cause to produce it. It arises usually from some local irritation, as in venesection, division of a vein, amputations, inclusion of the venæ comites during the ligation of large arterial trunks, tying of the funis, severe injuries, etc. It begins, as a rule, as an extension of inflammation from the tissues surrounding the vein to the vein itself, and shows a tendency to rapidly extend along the course of the vein, proceeding from smaller to larger venous trunks.

In this condition, the coats of the veins are frequently destroyed; and disintegrated blood coagula form, and are often swept into the blood-current. These small coagula subsequently lodge in the capillaries of other organs, and there generate metastatic abscesses, producing general pyæmic symptoms. In this respect, they differ in their results from the occlusion of vessels from emboli, which are not the result of suppurative inflammation; since they create, by their irritative properties, a recurrence of the condition to which they were originally due.

The symptoms which accompany these changes of diffuse or suppurative phlebitis are a tendency to develop a low grade of typhoid manifestations, ushered in with rigors and accompanied by a general increase in the severity of the preëxisting signs of local inflammation of the veins, as well as those of general debility and exhaustion in the patient.

When infants are attacked with this condition through ligation of the funis, death almost invariably supervenes.

VARICOSE VEINS. (*Varix, Phlebectasis.*)

By the term varix, is meant an excessive dilatation of a vein. Compensatory dilatation of venous trunks, which has been considered under hypertrophy of the coats of veins, is not to be confounded with a true varicose condition. True varices are most common in the submucous veins of the rectum (hemorrhoids), in the spermatic veins (varicocele, circocele), and in the veins of the lower extremity. Varicose veins have, however, been reported as existing at the elbow, on the arm between the elbow and the shoulder, in the neck, upon the internal jugular vein, on the face near the eyelids and the lips, and in the veins of the stomach, pharynx, œsophagus, and the small intestine. Such cases are, however, exceptional.

Varices are due to various causes. Among the most prominent may be mentioned—1st, an hereditary predisposition; 2d, a congenital tendency; 3d, a relaxed and debilitated condition of the system and of the venous coats; 4th, a slow heart's action, by which the venous return is retarded; 5th, occupations requiring prolonged standing upon the feet, or excessive and long-continued muscular exertion; 6th, certain diseases of the heart and lungs, which impede venous return; 7th, cirrhotic liver, or other conditions of that organ by which pressure is made either upon the portal vein or its radicals; 8th, constipation, by creating pressure upon the iliac veins; 9th, thrombosis of veins; 10th, pressure of tumors upon veins; 11th, hernial trusses, tight garters, and other common appliances which often impede venous return, and thus distend the veins below the point of pressure; 12th, violent exercise of certain sets of muscles, by which blood is propelled forcibly into veins naturally weak in their coats, as in long feats of running, jumping, waltzing, etc.

Varicose veins may be either circumscribed as a distinct sac, or the affected vein may be lengthened and tortuous, or unequally distended into a series of indistinct pouches.

The coats of the vein may undergo a compensatory hypertrophy, or may remain thin and atrophied. The tissues about the vein gradually become absorbed by long-continued pressure, and even bones may thus become indented. The dilated veins yield symptoms of a severe local pain of an aching character, in advanced stages, and often a sense of fullness, distention, and fatigue. Œdema about the ankle is often caused, after any severe exertion, by varices of the leg; and walking is sometimes impeded if the varicose tumor be

of large size. Itching is not an infrequent symptom of varicose conditions.

The appearance of these tumors is usually of a soft bluish tint, with a series of minute bluish vessels clustered around it.

Varicose veins often induce eczema and other skin affections dependent on irritation of the integument and its adjacent structures.

If the veins of the lower extremity be affected, a sense of coldness in the feet is quite a constant symptom, when the return circulation becomes markedly interfered with.

A peculiar tingling pain, distinctly localized at the seat of the tumor, may be developed if the minute nerve filaments be pressed upon or put upon an unnatural state of tension.

Attacks of lymphangitis and ulceration of the neighboring tissues are not infrequent complications of varices of old standing.

Rupture of varicose tumors often results in alarming hemorrhage unless controlled.

Varicose veins of the rectum (hemorrhoids) will be considered in detail in a subsequent chapter of this volume. They are associated, however, with all the symptoms mentioned as common to all varieties of this condition, and with certain other *special* symptoms, which are to a certain extent dependent upon the anatomical construction of the lower portion of the bowel.

PARASITES OF VEINS.

Occasionally the embryos of the tænia are found in veins; acephalocysts have been detected in the pulmonary veins; and in Egypt and at the Cape of Good Hope, parasites of a peculiar species are found in the portal system, and the veins of the mesentery and bladder, in fatal cases during epidemics, where death is preceded by hæmaturia and diarrhœa.

PHLEBOLITHES. (*Calculi of Veins.*)

These are round or oval masses not infrequently found in veins, and sometimes attached to the inner wall of the vein by a slender pedicle. They are found in the greatest frequency in the veins of the prostate gland during a state of hypertrophy, and in the veins of the pelvis, especially in those in the vicinity of the bladder.

These masses are usually found upon examination to be arranged in concentric layers, and are composed of albuminous or fibrous substances mixed chiefly with the phosphate of lime. The origin of

these bodies has been explained on the theory of transformed blood clots which have become impregnated with the least soluble salts of the blood, and also on the theory of their absorption through the walls of the vein. A sluggish circulation within a vein is supposed by some to favor the development of phlebolithes.

Many of these enumerated conditions, which may affect the arterial or venous system, require but the description already given to aid in their successful recognition during life, should a diagnosis be possible. I have appended, however, in the following pages, as a fit closing of the chapter on the surgical diseases of the blood-vessels, all those conditions, which to my mind seem liable to be confounded, arranged in the form of diagnostic tables. *Aneurism in general* will be here found contrasted with all conditions liable to result in error in diagnosis; the *various types* of aneurism will be found differentiated from each other, and from atheroma; and *fatty degeneration of arteries, embolism, thrombosis, adhesive phlebitis, suppurative phlebitis,* and *varices* of veins will be found with their symptomatology concisely stated.

ANEURISM.	TUMOR LYING UPON AN ARTERY.
CONDITION OF THE TUMOR.	
The tumor is soft, elastic and compressible.	The tumor *may* be hard and inelastic.
MOBILITY.	
The tumor is usually fixed.	The tumor is frequently movable.
EFFECTS OF PRESSURE.	
The tumor is diminished in size on direct pressure.	The tumor is unaffected by pressure.
The tumor is diminished in size by pressure on proximal side of vessel.	The tumor is unaffected by cutting off the arterial supply above.
The tumor increases in size when pressure over the distal end of the artery is made.	The tumor is not affected by pressure made over the artery on the distal side.
AUSCULTATORY SOUNDS.	
A *bruit*, or abnormal sound on auscultation, exists over the tumor.	A *bruit* may possibly be present, but is very rare.
This *bruit* is synchronous with the action of the heart, and in large vessels is often *double*.	This *bruit*, if present, is seldom constant, and seldom, if ever, *double*.
It is not affected by the position of the tumor.	It can often be arrested by change in position of the tumor.
PULSATION.	
The pulsation in the tumor is *expansive*.	The pulsation, if present, is of a *heaving* character, and not expansive.

SYMPTOMS IN COMMON.

Both may pulsate and yield a bruit on auscultation.
" " produce shooting pains along the course of nerves.
" " " stiffness in muscles, and muscular weariness.
" " " impaired motion in joints, if so situated.
" " " absorption of bone, caries, or necrosis.

ANEURISM.	ERECTILE TUMORS.
CONDITION OF THE TUMOR.	
The tumor is soft, elastic and compressible.	The tumor is usually of a spongy consistence.
LOCALITY OF TUMOR.	
The tumor is always located over the direct course of a vessel.	The tumor may be located where the arterial supply would be normally disproportionate to the size of the tumor.
APPEARANCE OF INTEGUMENT.	
The skin is usually normal.	The skin is frequently implicated.
EFFECTS OF PRESSURE.	
The distal side of the artery is usually decreased in volume.	The distal side of the main artery is often normal in volume.
PULSATION.	
The pulsation is uniform throughout the tumor.	The pulsation is often marked at circumscribed spots, or centres.
The pulsation is markedly expansive.	The pulsation is often not expansive in character.
SURFACE OF TUMOR.	
The tumor is smooth and regular in outline.	The tumor is often irregular on its surface, and indistinct in its outline.
AUSCULTATORY SIGNS.	
A *bruit* is well marked as a rule.	A *bruit* is often absent.

SYMPTOMS IN COMMON.

Both are indicated by the presence of a tumor.
" " associated with pulsation.

ABDOMINAL ANEURISM.	PULSATION OF A RELAXED AORTA.
PALPATION.	
A tumor is detected on palpation of the abdomen.	No tumor in the abdomen is detected on palpation.
PAIN.	
A *pain in the back* always exists, constant and often severe.	Pain in the back, if present, is not constant or severe.
AUSCULTATORY SIGNS.	
A *bruit* is heard over the seat of the tumor.	No *bruit* or abnormal sound exists over the seat of pulsation.
PULSATION.	
Expansive pulsation exists.	The pulsation is usually of a heaving character.
PERCUSSION.	
An abnormal area of dulness exists over the seat of aneurism.	No abnormal area of dulness on percussion is present.
CONDITION OF VESSELS.	
An atheromatous condition of the superficial vessels is often detected, or a previous traumatic history exists.	No atheromatous changes are detected in the vessels, nor is a traumatic history present as a source of origin.
ŒDEMA.	
Œdema of the extremities not infrequent from pressure.	Œdema in lower extremities seldom present, save from other cause.
FEMORAL PULSE.	
The femoral pulse is frequently decreased in volume.	The femoral pulse is usually normal in volume.

SYMPTOMS IN COMMON.

Both yield an abnormal area of pulsation.

" *may* be associated with *pain in the back.*

ANEURISM.	ABSCESS OVER A VESSEL.
Outline of Tumor.	
The tumor presents a sharp and well-defined outline.	The tumor is indefinite and obscure in outline.
Size.	
The tumor is usually of moderate dimensions.	The tumor is often of immense size.
Consistence.	
The tumor is soft, elastic and compressible.	The tumor is usually tense, or doughy from œdema.
Effects of Pressure.	
The tumor is diminished in size by direct pressure.	The tumor is unaffected by pressure.
Pulsation.	
Expansive pulsation is present.	The pulsation is heaving in character.
The pulsation is not affected by attempts to displace the tumor.	Pulsation is often arrested by attempts at displacement.
Appearance of Skin.	
The skin is usually normal in appearance over tumor.	Skin is usually red and œdematous.
Fluctuation.	
Fluctuation is seldom present.	Fluctuation distinct during the advanced stages.
Temperature.	
The local and general temperature is usually normal.	The local and general temperature is elevated.
Constitutional Symptoms.	
Chills and rigors are absent.	Chills and rigors are frequent as pus forms.

SYMPTOMS IN COMMON.

Both are indicated by the existence of a tumor.
" " often associated with pulsation.
" " " " " pain.

ABDOMINAL ANEURISM.	ABDOMINAL TUMORS.
MOBILITY OF TUMOR.	
The tumor is *immovable* as a rule.	The tumors are movable as a rule.
LOCALITY OF TUMOR.	
The tumor is situated in the line of the artery.	Abdominal tumors are often not in the line of the artery.
CONDITION OF TUMOR.	
The tumor is soft, elastic and compressible.	Abdominal tumors are frequently hard, and seldom elastic.
PULSATION.	
Expansive pulsation exists.	Pulsation is either absent, or heaving in character.
AUSCULTATORY SIGNS.	
A *bruit* (synchronous with the heart, and often double) is present.	Abnormal auscultatory sounds are usually absent.
EFFECTS OF PRESSURE.	
A diminution in the size of the tumor occurs from direct pressure.	No variation in the size of the tumor is detected on pressure being applied.
PAIN.	
A *constant pain* in the back exists (diagnostic).	Pain is often absent, or localized over the tumor.
FEMORAL PULSE.	
The femoral pulse is often decreased in volume.	The femoral pulse is seldom affected, save when the tumor is very large.

SYMPTOMS IN COMMON.

Both are indicated by a tumor.
" *may* be in the line of a vessel.
" " associated with pulsation.
" " " " pain.
" " " " change in volume of femoral pulse.

ABDOMINAL ANEURISM.	PAINFUL ABDOMINAL DISEASES. *Neuralgia, Renal, Intest. and Biliary Colics, etc., etc.*
PALPATION.	
A tumor is often detected by inspection and palpation, which is *immovable.*	No tumor can be perceived either on inspection or palpation.
PAIN.	
A pain exists in the *lumbar region,* which has been long continued, constant and distressing.	The pain is paroxysmal, with intervals of relief, and usually of short duration. It is seldom if ever local, or lumbar in location, but is diffused in some particular direction.
PULSATION.	
Expansive pulsation is detected.	No pulsation is present.
AUSCULTATORY SIGNS.	
A *bruit,* often systolic and diastolic, is heard over the seat of pain.	No *bruit,* or abnormal auscultatory sound, is heard.

SYMPTOMS IN COMMON.

Both are associated with *pain.*
" *may* be apparently unassociated with a tumor.
Pulsation and bruit may be undetected *possibly* in both.

ANEURISM OF ABDOMEN.	PSOAS ABSCESS.
TUMOR.	
The tumor is usually circumscribed and of moderate dimensions.	The tumor is elongated in shape, as detected by palpation and percussion.
The tumor is situated in the track of the aorta, or of some large vessel of pelvis.	The tumor is located over the track of the psoas muscle, at the outside of spine.
No tumor is perceived below Poupart's ligament in the groin.	A tumor is perceived in the groin below Poupart's ligament.
FLUCTUATION.	
Fluctuation is absent as a rule, but if present, is felt over the site of the tumor.	Fluctuation is often present in the thigh over the location of the tumor.
AUSCULTATORY SIGNS.	
A *bruit* is present on auscultation.	No abnormal auscultatory sounds are perceived.
FEMORAL PULSE.	
Femoral pulse often decreased in volume.	Femoral pulse normal in volume.
HISTORY OF PATIENT.	
No history of spinal disease exists.	A history of spinal disease is present, and often precedes the appearance of the tumor.
PULSATION.	
Pulsation of an expansive character exists.	No pulsation is detected as a rule.

SYMPTOMS IN COMMON.

Both are associated with *pain in the back.*

" " " " a tumor in abdomen.

" *may* be associated with fluctuation.

THORACIC ANEURISM.	INTRA-THORACIC TUMORS.
Location of Tumor.	
The tumor is always located in the course of the aorta.	The tumor may possibly be situated away from the direct track of large vessels.
Density of Tumor.	
Tumor is only moderately resistant to pressure.	The tumor is usually hard and markedly resistant to pressure.
Auscultatory Signs.	
A *bruit* is heard over the tumor, on auscultation.	No *bruit* is present, unless the tumor is in close relation to some large vessel.
Percussion.	
The area of dulness on percussion over the tumor is limited in extent.	The area of dulness on percussion is often extensive.
Pulsation.	
The pulsation perceived is *expansive* in character.	Pulsation is usually absent, but when present is *heaving* in character, save in malignant disease, when expansive pulsation may exist.
Condition of Face and Neck.	
Swelling and œdema of the face and neck exist, but *vary* in their severity and extent, because of changes in the line of pressure from the tumor.	Swelling and œdema of the face and neck, when present, are persistent and *constant* in their extent and severity.

SYMPTOMS IN COMMON.

Both are associated with local dulness on percussion.
" " " " swelling and œdema of face and neck.
" " " " possible dyspnœa, cough, pain and impaired deglutition.

THORACIC ANEURISM.	CONSOLIDATION AT APEX OF LUNG. *With a murmur in some vessel of Thorax.*
INSPECTION AND PERCUSSION OF CHEST.	
A *tumor* is usually detected within the thorax on inspection, palpation, or percussion.	No tumor is detected on palpation, but an area of dulness at the apex is perceived.
PULSATION.	
Pulsation is often perceptible over the seat of tumor.	Pulsation is absent.
AREA OF DULNESS.	
Dulness on percussion often extends beyond the median line of the thorax.	The area of dulness on percussion is always confined to one side, unless both apices are affected.
The area of dulness is always circumscribed.	The area of dulness is extended laterally downwards into the axilla.
AUSCULTATORY SIGNS.	
The murmur heard is generally diffused over an extended area.	The murmur is heard only over the direct course of the vessel, and is most distinct over the consolidated lung tissue.

SYMPTOMS IN COMMON.

Both are associated with *localized dulness* on percussion.
" " " " a *murmur* on auscultation.

ANEURISM OF BONE.	CANCER OF BONE.
Locality of Tumor.	
The tumor occurs in the line of some vessel.	The disease affects the articular heads of long bones, especially the lower end of the femur.
Condition of Tumor.	
The tumor is irregular in shape, and painful.	The tumor is hard, irregular, incompressible and painless in *its earliest* stages.
Consistence of Tumor.	
The tumor is of uniform consistence.	The tumor becomes elastic and fluctuant *in spots* during the advanced stages.
Rapidity of the Growth.	
The tumor grows slowly.	The tumor grows rapidly and often attains immense size.
Effects of Pressure.	
The tumor is modified in size and appearance by impeded circulation, through pressure on the supplying vessel.	The tumor is not affected by pressure, or by impeded vascular supply.
Mobility.	
The tumor can often be partially separated from the bone.	The tumor is immovably attached to the bone.
Appearance of Veins.	
The superficial veins are normal in appearance.	The superficial veins are markedly enlarged.

ANEURISM OF BONE (*continued*).	CANCER OF BONE (*continued*).
PAIN.	
Pain is slight, and is rather an *uneasy* feeling than severe.	Pain is deep, lancinating and constant; occurs often early in the disease.
PULSATION.	
Pulsation is detected early.	Pulsation is detected late in the disease, and is often absent.
FUNGOID.	
No tendency to fungoid growth exists.	"Fungoid excrescences" are frequent.
CACHEXIA.	
No cachexia is apparent.	A marked cachexia exists.
The neighboring glands are normal.	The neighboring glands are often involved.

SYMPTOMS IN COMMON.

Both are common in *young people.*
" pulsate.
" are indicated by a tumor.
" may produce pain.

CIRSOID ANEURISM.	PULSATILE TUMORS OF BONE.
Mobility of Tumor.	
The tumor is unconnected with the adjacent bone.	The tumor is firmly attached to the adjacent bone.
Outline of Tumor.	
The edges of the tumor are indistinct. It seems to arise by distinct cords beneath the integument.	The edges of the tumor are dense and hard.
Pulsation.	
Pulsation is marked, and is expansive in character.	Pulsation is indistinct, and is not markedly expansive in character.
Palpation.	
The walls of the tumor are irregular and knotted, but are soft to the touch.	The walls of the tumor are irregular in their outline, but contain spots of ossification.
Effects of Pressure.	
The tumor is altered in its size and appearance by direct pressure, or by pressure over its supplying vessel.	The tumor is only slightly modified by pressure either upon itself or its nutrient vessel.

SYMPTOMS IN COMMON.

Both are associated with the presence of a tumor.
" " " " pulsation.

ANEURISM.	ENCEPHALOID CANCER.
Rapidity of Growth.	
The tumor grows slowly.	The tumor is of rapid growth.
Consistence.	
The tumor is of uniform consistence and seldom fluctuates.	The tumor is of unequal consistence, being soft and fluctuant often in spots.
Multiplicity.	
The tumor is seldom multiple.	The tumor is frequently multiple.
Glands.	
The neighboring glands are unaffected.	The neighboring glands are usually involved.
Condition of Veins.	
The veins are normal in their appearance.	The superficial veins are prominent and tortuous.
Pulsation.	
The pulsation is *expansive* in character, and exists from the commencement.	The pulsation within the tumor appears only in the advanced stages, and is *heaving* in character.
Pain.	
Pain is often absent, and, if present, is frequently referred to distant localities.	Pain is an early and active symptom. Is severe and lancinating in character.
Effects of Pressure.	
Marked alteration in the size and appearance of tumor follows impeded circulation within it, or direct pressure upon it.	The effects of pressure, either upon the tumor or its supplying vessel, are unimportant.

SYMPTOMS IN COMMON.

Both are associated with the presence of a tumor.
" " " " pulsation.
" " " " pain.

ANEURISM.	ANEURISMAL VARIX.
Condition of Skin.	
The tumor is covered by normal integument.	The tumor, if near the surface, is usually blue or purple in color.
Rapidity of Growth.	
The tumor is sometimes rapid in its growth.	The tumor grows slowly as a rule.
Condition of the Veins.	
The veins are normal in the vicinity of the tumor, both as to their direction and apparent structure.	The vein implicated becomes enlarged, tortuous, and sacculated. The venous coats also become thickened, so as to resemble those of an artery.
Force of Pulse.	
The arterial volume and force of the pulse are either normal or decreased.	The force of the arterial pulse is usually preternaturally increased.
Auscultatory Signs.	
A *bruit* of a blowing character is usually present.	A "*pathognomonic fremitus*" is heard over the tumor, resembling the "buzzing of an insect," "the purring of a cat," etc.
This *bruit* is not continuous.	A "continuous souffle" is heard in the vein.
No venous pulsation exists.	A "*venous pulsation*" is present, which is synchronous with the heart's action, and which is increased by pressure on the proximal side of the vein.

ANEURISM (*continued*).	ANEURISMAL VARIX (*continued*).
Effects to Patient.	
The patient is unconscious of any abnormal sound or sensation within the tumor.	The patient is conscious of the peculiar fremitus, which affects the sleep, and leads often to a belief, on the part of the patient, that an insect is imprisoned within the affected part.
Venous Return.	
The venous return is usually unimpaired.	The venous return is usually interfered with, resulting often in œdema, coldness, pain, atrophy, etc., etc.

SYMPTOMS IN COMMON.

Both are indicated by the existence of a tumor.
" " " " " " " pulsation.
" " " " " " " abnormal sounds.
" " affected by pressure over tumor and its supplying vessel.

CIRSOID ANEURISM.	ERECTILE TUMORS.
Appearance of Tumor.	
The tumor is always irregular in shape, and distinct pouches are often present.	The tumor is often uniform in its general contour.
The tumor frequently reveals distinct arterial convolutions.	No distinct arterial convolutions are detected, as a rule.
The tumor apparently arises from distinct cords underneath the integument.	The tumor is usually very indistinct in its outline.
Fluctuation.	
Fluctuation is infrequent, but may exist when the vessels are very large.	Fluctuation is usually detected within the tumor.
Pulsation.	
Pulsation is strongly marked throughout the entire tumor.	Distinct *points* of pulsation are usually detected.
Location of Tumor.	
This type of aneurism is most frequently confined to the temporal, occipital and posterior auricular arteries.	No particular anatomical location is especially prone to become affected.

SYMPTOMS IN COMMON.

Both are indicated by a tumor.
" " associated with pulsation.
" *may be* " " fluctuation.

CIRSOID ANEURISM.	NÆVI.
Origin of Tumor.	
The tumor is seldom congenital.	The tumor is usually congenital, but may develop even after puberty.
Location of Tumor.	
The tumor is seldom sub-mucous in situation.	The tumor may be either sub-mucous, or sub-cutaneous in character.
The tumor is most frequent upon the scalp.	The tumor is most frequent upon the face.
Appearance of Tumor.	
The tumor is knotty and irregular in shape.	The tumor may be markedly elevated or flattened, but is uniform in appearance.
Auscultatory Sounds.	
A "bruit" is detected, but has simply a blowing quality.	A peculiar "*cooing noise*" is often detected in auscultation.
Pulsation.	
Pulsation is usually detected on palpation.	Palpation often perceives a peculiar "*vibratory thrill.*"

SYMPTOMS IN COMMON.

Both are associated with a tumor.
" " " " pulsation.
" " " " bruit.
" " " " altered color of skin.
" " " " elasticity and soft consistence.
" " " " alteration in the appearance of tumor on impeding venous return.

ANEURISM OF ARCH OF AORTA.	ANEURISM OF INNOMINATE ARTERY.
CONDITION OF FACE AND EXTREMITIES.	
The entire face, neck and both upper extremities are frequently livid, swollen and œdematous from pressure on the vena cava.	The right side only is affected, with obstructed venous return, as a rule.
APPEARANCE OF THORAX.	
The bulging of the chest wall over the tumor is often located on the *left* side, when present.	The bulging of the chest wall, if present, is confined to the *right* side of the thorax.
LOCATION OF TUMOR.	
The tumor is seldom, if ever, felt in the neck.	The tumor is often felt above the thorax, in the neck.
PULSATION.	
Pulsation may often be detected by pushing the fingers down behind the sternum, if direct palpation fails to perceive it;—or, by placing one hand on the sternum and one hand on the back, pulsation, if indistinct, may be perceived.	Pulsation is usually detected by direct palpation over the right sterno-clavicular articulation.
EFFECTS OF PRESSURE.	
Pressure on the right carotid, or right subclavian artery fails to diminish the pulsation.	Pressure upon the carotid, or subclavian artery of the right side causes either a marked decrease in, or a total arrest of the pulsation within the tumor.

SYMPTOMS IN COMMON.

Both are associated with an altered appearance of the face.
" " " " frequent bulging of the thorax.
" " " " pulsation and a bruit.

VARICOSE ANEURISM.	ANEURISMAL VARIX.
ANATOMICAL CONDITION.	
The artery and the vein are in communication, indirectly, through an intervening sac or tumor.	The artery and the vein have a *direct* communication. No intervening sac or tumor exists.
CONDITION OF VENOUS COATS.	
The venous coats are not markedly altered.	The venous coats are greatly thickened, and resemble those of an artery.
AUSCULTATORY SOUNDS.	
The "bruit" is *harsh* in character, and is heard most distinctly over the intervening sac.	The pathognomonic "buzzing fremitus" exists, and is widely diffused.
It is seldom carried into the vein.	It is equally detected in both vein and artery.

SYMPTOMS IN COMMON.

Both yield a "vibratory thrill" on palpation.
" " " venous pulsation.
" are associated with change in the color of adjacent skin.
" " " " defective venous return (often).
" " " " alterations in size and appearance, on pressure upon, or obstructed circulation within the artery.

VARICOSE ANEURISM.	VARICOSE VEINS.
PULSATION.	
Venous pulsation is present.	No pulsation in the vein is perceived.
BRUIT.	
A *bruit* can be heard over the tumor, which is *harsh* in character.	No *bruit* is heard over the tumor.
VOLUME AND FORCE OF PULSE.	
The force of the arterial pulse is often affected, and the volume frequently diminished.	The volume and force of the arterial pulse below tumor correspond with that of opposite side.
EFFECTS OF PRESSURE.	
The tumor shows marked alteration in its size and appearance by pressure on the artery.	The tumor is unaffected by pressure upon the arterial vessel below or above the tumor.
CONDITION OF SUPERFICIAL VEINS.	
The superficial veins may be normal. The deep veins are usually engorged from defective *vis a tergo*.	The veins are seen to be tortuous and dilated on the surface.

SYMPTOMS IN COMMON.

Both are associated with a tumor.
" " " " discoloration of the integument.
" " " often with pain over seat of tumor.
" " " " " impaired usefulness of limb.
" " " " " " venous return.

ATHEROMA OF VESSELS.

ORIGIN.

Atheroma may result from age, chronic alcoholism, gout, rheumatism, syphilis, exposure, or traumatism; all of which tend to produce a condition of chronic endarteritis.

It is most frequent in the male.

It may affect veins when exposed to irritation, as in *Aneurismal Varix.*

CONDITION OF VESSELS.

Rings of ossification are usually detected as the finger is moved along the affected vessel.

The affected vessels become liable to rupture from slight accidents, as a result either of ulceration of their walls, or a rigid and brittle condition of their coats.

When ligation is demanded, the loss of contractile power in the vessel and frequent breaking of the artery betray the disease.

FATTY DEGENERATION OF VESSELS.

ORIGIN.

It may be *primary*, when occurring in the old from general impairment of activity, and is in this case usually accompanied by similar changes in other parts; or,

It may be *secondary* to increased nutritive activity of the affected parts, as occurs in atheroma.

CONDITION OF VESSELS.

Spots of ossification are absent, if uncomplicated by atheroma; but a condition of defective contractility exists, as shown by the effects of cold, stimulation, etc.

The affected vessels show no decided tendency to easy rupture, unless an atheromatous condition coexists.

The ligation of fatty vessels is not associated with frequent breaking of the vessel, nor is its contractile power so seriously impaired.

SYMPTOMS IN COMMON.

Both frequently are associated with diminished arterial volume.
" " " " " dilatation of vessel at the affected portion.
" " " " " tortuosity of the vessel.
" " " " " impaired nutrition to tissues when excessive arterial supply is demanded, as in inflammation.
" " " " " local gangrene.
" " " " " local œdema.
" " " " " varicosities of veins.

EMBOLISM.	THROMBOSIS.
DEFINITION.	
Is an obstruction to a vessel, usually arterial, by a previously moving body.	Is an obstruction to a vessel, usually of the venous system, by a coagulum of blood formed at the seat of obstruction.
ORIGIN.	
The embolus may arise from fibrinous vegetations on the heart valves, resulting from a previous endocarditis, from small blood coagula floating in the current, or from foreign bodies in the circulation.	The thrombus may be the result of injury, inflammation, pressure from tumors or ligature, enfeebled or obstructed heart's action, or an altered and abnormal blood condition predisposing to coagulation or producing irritation of the vessels.
LOCATION.	
If of cardiac origin, the embolus most frequently lodges in the left middle cerebral artery. If due to disintegrated coagula, the lungs and abdominal organs are more frequently involved.	May affect any situation if an exciting cause exists.
ŒDEMA.	
Œdema is seldom present as the arteries are chiefly involved.	Œdema is a common symptom from obstruction to the venous return.
PARALYSIS.	
Sudden paralysis, usually hemiplegic, and *aphasia* are produced by cerebral embolism.	Aphasia is not usually present in cerebral thrombosis, and paralysis may be absent.

ADHESIVE PHLEBITIS.	SUPPURATIVE PHLEBITIS.
ORIGIN.	
This condition is primarily one of the venous coats.	This condition always begins in tissues external to the vein.
DEVELOPMENT.	
It is usually a circumscribed disease.	It is rapidly extended along the course of veins, usually from the smaller toward larger trunks.
GENERAL HEALTH.	
It may occur in normal health.	Occurs in abnormal conditions of the system or in debility, but never in robust health.
HISTORY.	
It may follow injuries, ligature, amputations, or abnormal blood conditions predisposing to irritation.	It may follow any form of local irritation, as in venesection, ligature of veins or the inclusion of venæ comites with large arterial trunks. It occurs in infants from ligating the funis.
PYÆMIC SYMPTOMS.	
Pyæmic symptoms are absent, as the coagulum in the vein does not disintegrate.	Pyæmic symptoms are usually produced by disintegration of the thrombus formed in the vein, and by occlusion, from the loosened detritus, of capillaries in other organs.

SYMPTOMS IN COMMON.

Both may be associated with pain.
" " " " " œdema.
" " " " " prominence of neighboring veins.

DISEASES OF THE JOINTS.

DISEASES OF THE JOINTS.

The *surgical* DISEASES OF THE JOINTS may be thus enumerated:

A. INFLAMMATORY DISEASES.

1st. Of the synovial membrane: "*Synovitis.*" 9 varieties.
- Acute.
- Subacute.
- Chronic.
- Scrofulous.
- Rheumatic.
- Gouty.
- Pyæmic.
- Gonorrhœal.
- Syphilitic.

2d. Of the general structures entering into the formation of a joint: "*Arthritis.*" 4 varieties.
- Acute.
- Chronic.
- Rheumatic.
- Syphilitic.

B. ANCHYLOSIS—varieties,
1. Fibrous.
2. Osseous.

C. DROPSY OF JOINTS: "*Hydrarthrosis.*"

D. ARTICULAR NEURALGIA.

E. LOOSE CARTILAGES IN JOINTS.

F. CONGENITAL AND ACQUIRED MALFORMATIONS.

The important points, which directly bear upon the diagnosis of each of these conditions, will first be *separately reviewed*, and, as a summary, the points of the more important diseases will be found arranged *in contrast*, in the closing pages of this chapter.

I shall consider the various surgical affections of the joints in the following order:

I. *Diseases of Joints in general.*
II. *Diseases of Special Joints.*
III. *Congenital or acquired Deformities of Joints.*

I.

DISEASES OF JOINTS IN GENERAL.

SYNOVITIS.

By this term, is commonly designated those changes within a joint dependent solely upon an inflammatory condition of its synovial membrane.

Inflammation affecting this membrane is frequently of an ordinary and simple character, such as may result from injury directly applied to the joint, from some severe strain or wrench, from exposure of the joint to dampness or to atmospheric influences, or by an extension of inflammation from some neighboring structures.

If this form of disease exists, no special form of nomenclature is generally used, although the terms *simple synovitis* and *common synovitis* are not infrequently applied to it.

This type of disease is essentially local in its character, and is confined, as a rule, to one articulation only. Its various degrees of severity have led authors to describe it as of three types: the *acute form*, where the inflammatory changes are excessive; the *subacute form*, where the symptoms of disease are less active; and the *chronic form*, where the evidences of active inflammation no longer exist.

There are constitutional conditions, however, in addition to those of a local character, which *predispose* towards the development of synovitis. Among these constitutional causes may be mentioned; 1st, *scrofula*, which not only may prolong an attack of simple synovitis, causing it to assume peculiarities common to that condition of the system, but may even, in itself, become an exciting cause; 2d, *rheumatism*, which, among the poorly clad and nourished, and especially in those exposed to variations in temperature, tends also to induce synovial inflammations; 3d, *gout;* 4th, *pyæmia*, as occurs often after operations, severe injuries, parturition, etc.; 5th, *syphilis;* and 6th, *urethral inflammation* of an acute gonorrhœal type, from some unexplained reason, is not infrequently followed by symptoms of synovitis, in joints often far removed from the seat of disease.

To these various types of synovitis, special names have been given from their apparent source of origin, such as *scrofulous*, *rheumatic*, *gouty*, *pyæmic*, *gonorrhœal*, and *syphilitic*.

Acute Synovitis.

This condition is relatively more frequent in males than in females, and occurs more often in adult life than during youth. It may remain confined in its progress to the lining membrane of the joint only, or it may extend and gradually involve the cartilages, bone, and ligaments (in which case it is more properly called arthritis).

The symptoms indicative of acute synovitis vary greatly with its exciting cause, the joint affected, the severity and extent of the inflammatory process, and with the constitutional condition of the patient. When the hip-joint is the seat of the disease, greater constitutional disturbance is usually produced, in proportion to the extent of the disease, than in any other joint of the body.

There are certain symptoms which, however, are of diagnostic value, and which, although they admit of variations, are still comparatively uniform. Among these we have:

(1.) *Pain.*—This is accompanied, as a rule, by a sense of distention within the affected joint. It is greatly increased by movement of the joint in certain directions, and is often located away from the seat of the disease, especially when the hip-joint is affected. This peculiarity arises from irritation of nerves in relation with the affected joint; the evidence of this irritation being perceived at the peripheral distribution of the nerve.

(2.) *Swelling.*—This is not, usually, a uniform swelling, but an irregular protrusion of the distended pouches of the synovial membrane, which appear most distinctly where the tissues which cover them are the least resistant. The situation and appearance of these distended pouches vary with the anatomy of the diseased joint.

(3.) *Fluctuation.*—In superficial joints, fluctuation can often be detected, if the amount of fluid secreted into the joint sufficiently distends the synovial pouches. This symptom, however, is not as well marked in conditions of a chronic character, or in an excessively prolonged case of simple synovitis, since the products of the inflammatory process become gradually more solid, and transmission of the impulse wave is thus impeded.

(4.) *Local heat and redness.*—This symptom depends somewhat upon the joint affected. It is most marked in those joints which lie superficially and in close proximity to the integument. It is also greatly modified by the extent of the inflammatory process.

(5.) *Position of the limb.*—In almost all joints affected with acute synovial or articular inflammations, there exists a marked tendency

toward flexion of the diseased joint. The joint also gradually becomes more or less rigid in proportion as the muscles become involved, through irritation of the articular nerves and a subsequent reflex act upon the muscular structures.

This condition of flexion of the joint is due, in part, to over-distention of the joint from the rapid increase of the synovial fluid, and, in part, to the effect of contraction of the flexor muscles, whose power surpasses that of the extensor muscles of the extremities.

The position of limbs affected with articular inflammation is often of great diagnostic value. If it remain too long unrelieved, there is danger of anchylosis of the joint.

Suppurative Synovitis.

In acute synovitis, the secretion within the joint occasionally loses its synovial character and *suppuration* commences. This condition is sometimes called *acute articular abscess.* It is usually accompanied by rigors, and by a very marked degree of constitutional disturbance. Occasionally typhoid symptoms develop in connection with suppuration within the cavity of joints, and the local evidences of disease usually become markedly intensified.

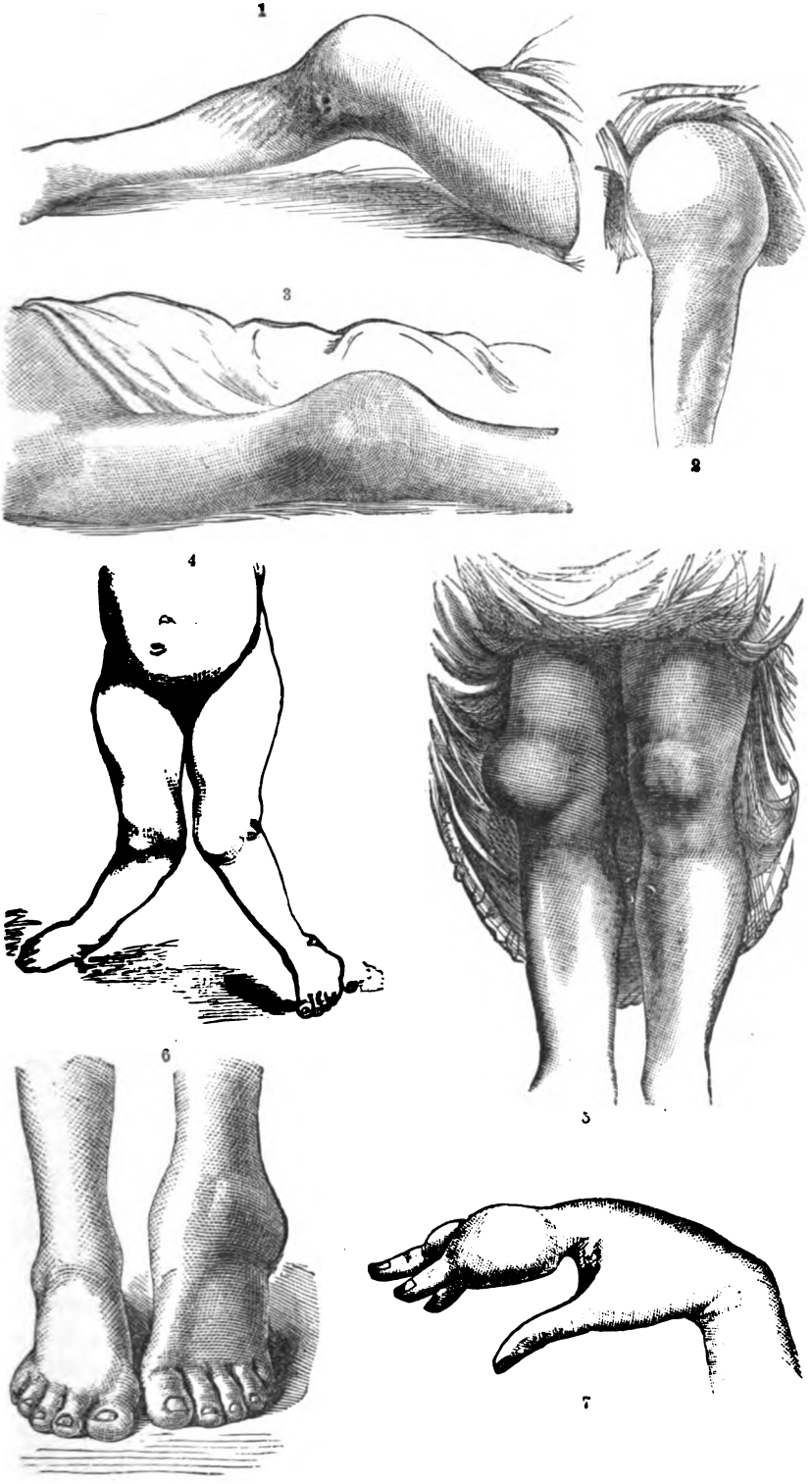
Thus we often perceive a rapid increase in the tumefaction about the affected joint; and a decidedly phlegmonous appearance to the investing tissues is developed. Abscesses form within the surrounding areolar tissue, and if at first separate from, soon join with the articular cavity. The general tissues entering into the formation of the joint soon become involved, the ligaments soften, the cartilages and bone become affected, and the joint disorganizes. Subsequently the sinuses may become closed as the discharge diminishes, and an anchylosed condition of the joint may ensue; or the pain and discharge may exhaust the patient, and excision or amputation may be required.

Acute synovitis is to be differentiated from rheumatism, from localized periostitis near a joint, from suppuration external to a joint, and from hydrarthrosis. The points of distinction will be found embodied in differential tables at the close of this chapter.

Chronic Synovitis.

This condition may follow the acute or subacute form of simple synovitis, but it is more commonly the result of some constitutional condition, such as syphilis, scrofula, gout, rheumatism, or gonorrhœa.

PLATE III.



1. Ostitis of condyles with posterior luxation. 2. Hydrarthrosis of knee. 3. Arthritis with ostitis. 4. Knock-knee or genu-valgum. 5. Housemaid's knee (double). 6. Arthritis of ankle-joint, with ostitis of astragalus, as compared with the healthy ankle. 7. Enchondroma of the phalanges.

It is not always possible to define, however, the exact blood condition upon which the inflammatory process is dependent, since the distinctive features of each may not be well marked.

In this condition, there may often exist considerable swelling, some pain, and usually a marked impairment in the normal movements of the affected joint.

Occasionally a *peculiar crepitus* — (of a crackling character) — may be detected, and, in some cases, a sensation of some loose body within the joint may be perceived by the hand if placed in contact with it. This latter symptom has been explained by the presence of local plastic effusions.

Chronic synovitis, if unconnected with some constitutional taint, generally terminates in recovery, although a marked tendency toward relapse into a state of subacute inflammation is very often present.

Scrofulous Synovitis.

This condition is one which is developed in connection with a scrofulous diathesis. It has been described by some authors under the head of *gelatinous* or *pulpy degeneration* of the synovial membrane of joints. It is usually associated with changes in the cartilages and the bone. It is most frequent in early life, and usually occurs before the age of puberty. It frequently owes its origin to some exciting cause, such as a wrench, contusion, fall, etc., but, in some cases, it seems to be of spontaneous origin. In its early stages, the symptoms seldom exhibit an acute form, but the disease is evidenced rather by a stiffness in the affected articulation, associated with a soft, elastic, and colorless swelling, which is spread over the whole aspect of the joint. This peculiar swelling is most apparent when the superficial joints are involved.

No distinct sense of fluctuation can be detected in scrofulous synovitis, since the exudation is too gelatinous to transmit a wave impulse; but a peculiar *doughy feel* exists which is characteristic.

Scrofulous synovitis, in its white color, differs markedly from cancer or abscess; and, in its doughy feel and indistinct fluctuation, from dropsy of a joint, or synovitis of a purely inflammatory type.

Pain is not a prominent symptom in the early stages of scrofulous synovitis, but, as the disease develops into an arthritis, and the cartilages and the bone become involved, the "*starting*" and "*growing*" pains, so often described, become a prominent symptom, especially at night-time.

Crepitation also appears, when the destructive process involves the

cartilaginous and bony structures, unless exuberant granulations for a time mask the true condition of the joint.

Suppuration not infrequently accompanies the disease when advanced, and often indicates the fact that destruction of the joint is fast being accomplished. In these cases, all the symptoms of acute articular abscess, as described under acute synovitis, may be present.

If the progress of the disease is, however, toward recovery, the swelling external to the joint becomes gradually more solid and less elastic, and diminishes also in its size; and the appearance of the part more nearly approaches the normal standard.

The joint seldom, however, regains its full capacity of movement, and a tendency toward relapse is present, which may often prove most obstinate.

Scrofulous synovitis is to be diagnosed from suppuration external to a joint, from acute articular abscess, from cancer, from dropsy of a joint, and from synovitis of the acute type. These points will be found enumerated in the diagnostic tables at the close of this chapter.

Rheumatic Synovitis.

This condition is not to be mistaken for acute articular rheumatism, since, in rheumatic synovitis, the joint is primarily affected, and the constitutional disturbance is a secondary result of the local disturbance; while, in rheumatism, the contrary is the case.

This condition is one which seems to be developed by exposure, dampness, low vitality, and all the other causes which ordinarily predispose to the rheumatic diathesis. It seems to centre itself, however, in the *synovial membrane* of the joint rather than in the *fibrous tissue*, as is the case in acute rheumatism or rheumatic fever, and to be, to a certain extent, independent of any excess of lactic acid in the blood. It has no point of special surgical distinction from other forms of synovitis, save in its mode of origin and its apparent indirect connection with some abnormal condition of the system at large.

Gouty Synovitis.

This condition is produced by sudden excess of uric acid in the affected part, if the attack be acute in character. It may, however, gradually assume a chronic type and be indefinitely prolonged.

The gouty form of synovitis is almost invariably associated with a deposition of either uric acid or some of the urates (principally

that of soda), into the cavity of the joint, its cartilages, the substance of its ligaments, its investing muscles, and the connective tissue of the part. The deposit of urates has been also perceived in the bone and its periosteum.

These deposits are often termed *chalk stones* or *chalky deposit*, from their whitish color and their consistence. They are usually found in the smaller joints, especially in the joints of the feet and the hands, although a deposition may occur in any joint, and even in the cartilages of the ears, and in the prepuce. Protuberances are thus produced which distort and cripple the articulation affected, until they approach the surface, when they often ulcerate through the integument, and are thus discharged.

Pyæmic Synovitis.

This condition is dependent upon an abnormal blood condition termed pyæmia. It may follow parturition, injury, phlebitis, amputation or operations, fevers, and all other causes which may tend to create or favor systemic infection.

The condition present in the joints is but one of the many results liable to occur from this variety of blood-poisoning. The variety of exudation into the joint is usually a thin sero-pus; and changes, dependent on excessively rapid cell growth, are developed.

These changes are accompanied by pain (which may often be violent in character), and, later on, by heat, redness, swelling, and fluctuation, if the affected joint be superficially situated.

The number of joints involved may vary considerably. It is not infrequently the case, to find almost every joint infiltrated with pus, while, in some cases, only one articulation may be attacked.

The extent of the disease, as regards the structures of the joint, also admits of great variations. In some cases, only the synovial membrane is implicated in the inflammatory process, while, in others, the joint becomes thoroughly disorganized.

Gonorrhœal Synovitis.

Sir Benj. Brodie first described this disease under the name of *gonorrhœal rheumatism*, although he, at that time, recognized the dependence of a similar condition, in some cases, upon an existing purulent ophthalmia, and, in others, upon the urethral irritation produced by the introduction of an instrument into the cavity of the bladder.

It may attack only one, or occasionally several joints, and the

knee-joint seems to be the one most frequently involved. It may continue for a period of time varying from a few weeks to several months, or even years.

A marked tendency to relapse seems to be a distinguishing trait of this affection, and joint after joint may become involved in succession.

Suppuration is rare in this form of synovitis, but the movements of the affected joint are often permanently impaired from a thickened and indurated condition of the synovial membrane. Permanent rigidity of the joint sometimes occurs if the inflammation involves the cartilaginous structures.

A theory has been advanced by Barwell that this condition is associated with a prostatic phlebitis, in those cases dependent upon any urethral inflammation.

Syphilitic Synovitis.

This type of synovitis is usually of a sluggish character, and may appear in the early stages of secondary syphilis, although it is perhaps more frequently an associate of the tertiary form of disease, especially when the bones or their periosteal coverings are involved. It seldom affects one joint only, and is characterized by nocturnal pains which are often extremely severe. It usually is accompanied by symptoms elsewhere which indicate a syphilitic condition, and which assist greatly in confirming the diagnosis. If the disease occurs during the early stages of secondary syphilis, it more frequently accompanies some of the *papular* eruptions.

ARTHRITIS.

By the term arthritis is meant an inflammatory disease of an acute or chronic type, *which involves the whole or greater part of the structures*, which enter into the formation of a joint. It may commence either in the synovial membrane, in the cartilages of the joint, in the articular ends of the bone, and, in rare instances, in the capsular or investing ligaments.

In arthritis, the principal changes which occur within the joint are detected in the cartilaginous structures. In the acute form of the disease, the cartilages undergo erosion and ulceration, and portions of the articular ends of the bone are thus denuded and rendered vascular and roughened. The synovial membrane also becomes thickened, opaque, and vascular; the latter condition being most apparent where the erosion of the cartilages has occurred. All the

ligaments and surrounding tissues are liable to participate in the destructive process, and to become either thickened by plastic material or infiltrated with pus.

Arthritis may be either *acute; chronic; rheumatic* in its origin; or dependent upon *syphilis*. It may result from wounds of joints, from sprains, from fractures in the vicinity of joints, from diseases of the bone (as in caries or necrosis), from extension of inflammation from outside tissues, from the progressive development of an acute synovitis, and from pyæmic and scrofulous conditions. It may also occur in certain blood conditions which favor the development of inflammation, as in renal disease, certain fevers, and when poisons are present in the circulation.

The diagnostic symptoms of arthritic inflammation are:

(1.) *Pain.*—In the acute form, this pain is often excruciating. It is throbbing in character, is greatly increased by movement, and, in many cases, examination of the limb without the aid of anæsthetics is impossible. The pain is usually associated with *nocturnal exacerbations*, and is often confined to one special locality within the affected joint. All attempts to approximate the diseased articular extremities increases the pain, while extension of the parts sufficient to separate the bony surfaces of the joint often affords the greatest relief. *Spasms*, or *startings* of the limb, which are of a very painful and distressing character, occur at times, chiefly in the night, and are created by a reflex muscular act, causing a close approximation of the diseased surfaces of the joint.

(2.) *Local heat within the joint.*—Arthritic disease is usually associated with a marked increase in the local, and possibly in the general temperature; and is accompanied, as a rule, by a superficial reddening of the integument. This elevation of temperature is most marked in the acute form, and least of all in the rheumatic type.

(3.) *Swelling.*—The swelling in arthritic disease is uniform over the affected joint, and differs, in this respect, from all forms of synovitis, save the scrofulous variety; since, in them, the synovial pouches alone are prominent. It is seldom excessive until suppuration is in active progress, and usually gives to the touch a soft, doughy sensation without much elasticity or fluctuation. As pus forms, or when the synovial fluid is rapidly augmented, the joint may increase in size with great rapidity and yield distinct fluctuation over the points where the fluid approaches the integument.

(4.) *Position of the limb.*—In arthritic disease, as in synovial in-

flammation, the position of the limb is altered from its normal attitude in such a way as to afford the greatest ease to the inflamed joint. Thus the knee, if affected, is usually semiflexed and turned outward; the thigh is adducted, in case the hip be diseased and the capsule not perforated; and the forearm is bent upon the arm, if the elbow be involved.

(5.) *Constitutional disturbance.*—A marked increase in the temperature and pulse is usually present in the acute form of arthritic inflammation. As suppuration develops, rigors are frequent, and symptoms of exhaustion from pain and loss of rest may, in some cases, rapidly ensue. Hectic, and symptoms of general nervous irritation, may precede or accompany those of exhaustion; and death has not infrequently relieved the sufferer, if surgical assistance has failed to successfully combat the disease.

(6.) *Local Symptoms.*—In addition to pain, heat, and redness of the part, local swelling, and an abnormal attitude of the limb, arthritis, in its severer forms, is gradually followed by symptoms indicating a rapid disorganization of the joint. The accumulated pus at length finds escape externally, and sinuses remain to drain the open joint. The bones grate upon each other, giving great suffering to the patient; the ligaments no longer retain the bones in their proper position, and an excessive mobility is perceived. Caries and necrosis attack the bony structures; ulceration enlarges the openings formed by the escape of pus; and the imperfect return of venous blood causes extensive œdematous infiltration of the soft tissues, and gives to them a dark purplish color.

In this condition, anchylosis is in many cases the best prognosis which can be extended by the surgeon.

CHRONIC RHEUMATIC ARTHRITIS.

This condition has been described under the terms "nodosity of joints," "rheumatic gout," "chronic rheumatism," "morbus coxæ senilis," and "chronic osteo-arthritis."

It may affect both the large and the small joints of the body. It probably commences as a chronic inflammation of the synovial membrane, and may be produced either by a constitutional condition following rheumatic fever or exposure, or as a local affection attributed to over-exertion, or some injury.

The larger joints are more frequently affected in males; while, in the female sex, the smaller joints, especially those of the fingers, are more often implicated. It is more frequently met with in advanced

life, although it is occasionally present in youth. It affects all conditions of life, but has a more gouty character when present among the opulent and indolent classes.

It is essentially chronic in its course, and, as a rule, progresses steadily when once developed, until the affected joints become to a greater or less extent useless and disorganized.

This disease occasionally exhibits periods of temporary quiescence, and may remain stationary for an indefinite length of time; but it is seldom permanently arrested in its progress.

It is manifested during life by pain, which is chiefly experienced at night or upon attempts at motion after long intervals of rest to the affected joint, and which is of an *aching* character; by enlargement and ultimate deformity of the joint; by rigidity and stiffness in the articulation; and by a peculiar crackling noise, which is occasionally heard when the affected joints are used. Cold and dampness increase the symptoms, especially the pain, and often render rest almost impossible.

There is little or no tendency toward suppuration, nor does absolute anchylosis often occur; although the affected joints may simulate that condition. Bony outgrowths frequently develop upon the articular surfaces of the joint, and, by their mechanical impediment, often greatly impair its function.

In cases where the motion of the joints affected is greatly interfered with, the muscles of that region may undergo atrophy from disuse. The peculiar crackling noise which often follows attempts at motion, especially after the joint has been in a state of rest, is often audible both to the patient and the surgeon, and is produced by the rubbing together of the altered bony surfaces. This symptom is most frequently well marked in the hip-joint, and can be best perceived in the morning on the patient attempting to arise.

Chronic rheumatic arthritis does not appear to shorten the actual *duration* of life, but in severe cases it frequently renders the person afflicted incapable of support, and even in a state of utter helplessness.

It is very frequently developed in the hip and knee joints to a marked degree; and, in the joints of the fingers, it is by no means uncommon. When the affected joint is superficially situated, the peculiar bony growths, having the appearance of irregular knots, are hardly to be confounded with any other known affection.

ANCHYLOSIS OF JOINTS.

By Anchylosis is meant an abnormal rigidity of a joint. Anchylosis may be of two varieties, *true* and *false*. True anchylosis, which is also called *synostosis*, includes all varieties of fixation of joints where union of the contiguous surfaces occurs through bone-tissue. False anchylosis may be either of the intra-capsular or the extra-capsular variety, and signifies a fixation of a joint through the intervention of fibrous bands or adhesions.

In true or osseous anchylosis, the joint is, as a rule, permanently destroyed; although, in rare cases, the bony deposit is found to lie entirely outside of the articulation.

Impaired mobility of a joint may, however, be occasionally independent of either true or false anchylosis. Thus, in chronic rheumatic arthritis, the bony growths upon the articular surfaces of the joint may act as mechanical impediments to its normal power of movement; old cicatrices may also so impair the motion of a joint as to simulate an anchylosed condition; and muscular contraction may produce the condition of "articular rigidity," which is to be differentiated from anchylosis.

Anchylosis, whether it be of the true or false variety, usually results from an inflammation within the affected joint, which has to a greater or less extent led to a destruction of its component parts, and which has subsequently been followed by a reparative process. In a few isolated cases, however, anchylosis of some of the minor joints may be met with in advanced life without any such obvious cause being discovered to account for its presence.

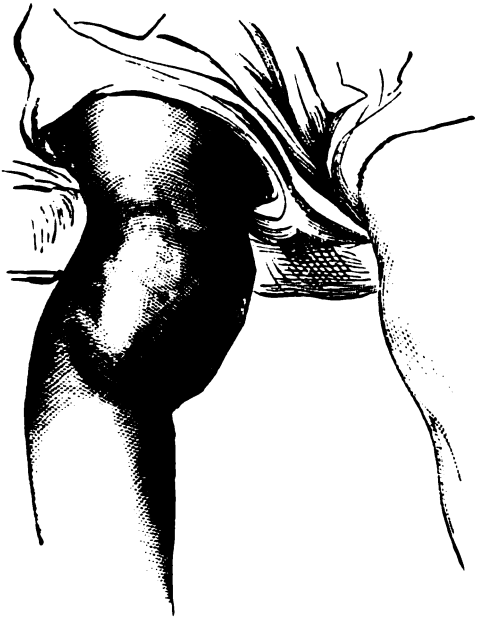
When the hip or shoulder joints are apparently affected with anchylosis, care should be exercised lest the increased mobility which may occur in the pelvis, or at the scapula, be not mistaken for motion in the articulation.

In subsequent pages, at the close of this chapter, will be found enumerated the points of distinction between osseous and fibrous anchylosis of joints, arranged in contrast as an aid to memory and reference.

DROPSY OF JOINTS. (*Hydrarthrosis.*)

This condition consists of an increase in the synovial fluid of a joint, without symptoms of inflammatory processes being present. It has been described under the name of "*hydrops articuli*," and has been compared to those conditions of serous membranes, where a

PLATE IV.



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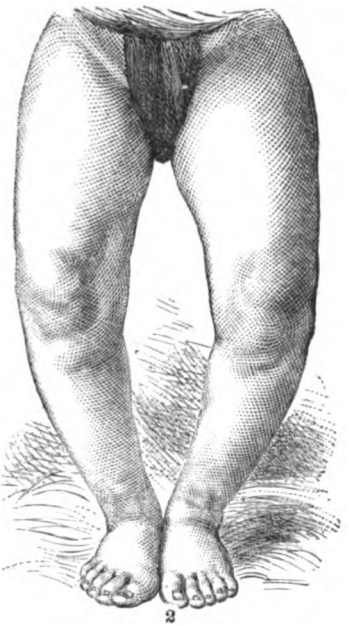

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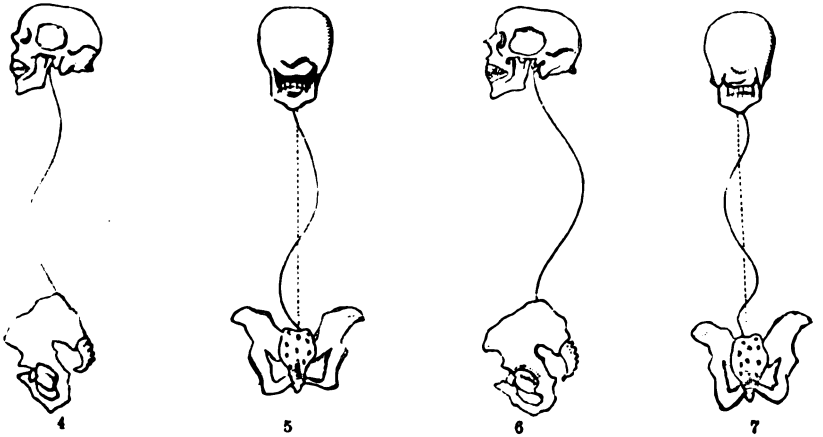

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1. Caries and necrosis of tibia. 2. Bow-legs. 3. Strumous arthritis of elbow. 4. Lordosis. 5. Double lateral curvature. 6. Kyphosis. 7. Quadruple lateral curvature.

deposit of fluid is present without apparent cause or marked symptoms, as in hydrocele. It is in reality, however, associated with some structural changes within the lining membrane of the joint, and the fluid, when drawn by an aspirator, differs markedly from the normal synovial secretion, resembling rather that of ascites or hydrocele.

This disease is most frequently found in the knee and elbow joints. It is usually the result either of a previous synovitis, or of a weakened and depressed vital condition when exposed to some exciting cause, as cold, exposure, or slight violence.

The fluid usually forms with considerable rapidity, and the joint presents the peculiar deformity produced by distention of its synovial pouches.

Pain may be entirely absent, motion may be normal or only slightly impaired, and the skin may exhibit no redness or œdema. Fluctuation is usually a well-marked and diagnostic symptom, and can be, as a rule, most positively perceived by placing the hands upon the anterior and posterior of the joint, thus avoiding any mistakes of sensation through displacement of muscles or tendons.

Dropsy of joints should be differentiated from abscess of joints, and from scrofulous synovitis.

ARTICULAR NEURALGIA.

This condition may occur in conditions of general nervous depression; from sympathy with some abnormal condition of organs; from injury to, pressure on, or irritation of nerves, or degenerations of nerve trunks; from concentrated attention to a part, with imaginary or real anxiety concerning it (as occurs often in those of a hysterical temperament); from local causes; and from certain blood conditions, as in rheumatism, gout, pyæmia, etc.

In this condition, the *pain* is out of proportion, as a rule, to the apparent lesion at the affected joint. This pain may be distinctly circumscribed, or, possibly, diffused over a large area. It may be periodical or exacerbating; and may often be absent during sleep or when the attention is diverted from the seat of disease.

This pain is not usually increased by firm pressure exerted from a distance upon the articular surfaces of the joint, although occasionally a *fine crepitation* may be detected, which is situated near the surface, and which differs markedly from the *grating* crepitus perceived when the cartilages of a joint are eroded.

Exaggerated tenderness of the joint, especially in the integumentary structures, is a frequent symptom of this affection.

The swelling about the affected joint is usually limited in amount, and is rather superficial to the joint than within its cavity. It is due, as a rule, either to the increased amount of blood in the capillary vessels, or to a slight infiltration of serum into the subcutaneous areolar tissue.

Spasmodic or convulsive action of the muscles is sometimes developed in the course of this disease, if movement be attempted; and a rigid condition of the joint may, occasionally, be found to exist, in which case the affected joint is usually in an abnormal attitude. This rigidity is due to muscular contraction however, as can be easily demonstrated by the administration of an anæsthetic, when the joint will admit of free and perfect motion.

LOOSE CARTILAGES IN JOINTS.

These bodies are more frequently met with in adult life than in youth. They consist of white or yellowish bodies, and may be either of soft consistence, or hard and glistening in character on removal. They are usually attached to some portion of the joint, and are probably developed in the vascular processes of the synovial membrane.

They vary greatly in their size; some being no larger than a small kernel of corn, while, in rare cases, they may nearly equal the patella in size. They are either round, oval, flattened, or nodulated in form, and vary in number from one to twenty or thirty in a single articulation.

They are most frequently present in the knee-joint; and least in frequency, of all the large joints, in the hip. They contain a few cartilage cells, are often covered with epithelium, and, occasionally, are partly osseous in character; but, in the majority of cases, they are chiefly fibrinous.

Loose cartilages do not always occasion symptoms. When caught between the articular ends of the bones by some sudden movement, a violent pain is generally produced, and an inability to control the limb results until dislodgement either spontaneously takes place or is effected by mechanical means.

Syncope often occurs from the severity of the pain which accompanies such a condition. This pain is due, in all probability, rather to the stretching of the ligaments by the wedge-like action of the

foreign body between the bones than to compression of the loose cartilage.

After one such attack has occurred, repeated attacks are liable to follow without any apparent exciting cause.

In the following pages will be found contrasted the prominent points of diagnosis pertaining to *acute synovitis, scrofulous synovitis, hydrarthrosis, acute arthritis, chronic rheumatic arthritis, syphilitic periostitis* in the vicinity of joints, *suppuration external to joints, fibrous anchylosis, bony anchylosis,* and *articular neuralgia.*

I. DISEASES OF JOINTS IN GENERAL.

SYNOVITIS.	RHEUMATISM.
Is usually a purely local inflammation independent of any blood condition.	Is a disease dependent on an abnormal state of the blood.
LOCALITY.	
Is a unilateral affection as a rule. One joint only is affected.	Is generally a bilateral affection. Several joints are usually involved simultaneously.
SWELLING.	
The swelling about the joint is irregular, and due to the distension of the synovial pouches.	The swelling about the joint is uniform, if severe.
INTEGUMENT.	
The integument over the affected joint is usually normal.	The integument over the affected joints is usually reddened.
SECRETIONS.	
The secretions are normal in reaction.	The secretions are usually strongly acid in reaction.
PAIN.	
The pain is only of moderate severity.	The pain in the affected joints is often excessive.
HEART.	
Heart complications are seldom present; if present they are of independent origin.	Heart complications are frequently the result of the abnormal blood-condition.
TEMP. AND PULSE.	
The constitutional disturbance is generally slight, unless the acute variety exists.	The constitutional disturbance is often alarmingly severe.

SCROFULOUS SYNOVITIS.	HYDRARTHROSIS.
AGE AFFECTED.	
Is usually a disease of youth.	May occur at any age.
PAIN.	
The pain is at first slight and often remote from the seat of actual disease. In the latter stages, however, the pain becomes local and severe; is worse at night, and is increased by impinging the articular surfaces of the joint.	Pain *may* be present in the early stages, if the disease is of inflammatory origin, but is often absent. A sense of *distension* within the joint is, in the advanced stages, more often the only source of discomfort.
APPEARANCE OF JOINT.	
The normal bony prominences of the joint are concealed, and the *hollows* normal to the joint are effaced.	The normal bony prominences of the joint are still apparent, but the *synovial pouches* are distended, rendering them prominent.
MOTION.	
The normal movements of the joint are impaired.	Motion of the affected joint is only slightly embarrassed.
SKIN.	
The skin over the affected joint is milky-white in color, shiny in appearance, and the blue veins on the surface are apparent.	The integument over the joint is of normal appearance.
SINUSES.	
Sinuses form in the latter stages.	Sinuses seldom, if ever, exist.
CREPITATION.	
Crepitation appears as the joint undergoes disorganization.	Crepitation is absent, if no complications are present.
PALPATION OF TUMOR.	
The tumor is soft, doughy and fluctuant before sinuses form.	The tumor is fluctuant, and elastic to the touch.
HISTORY OF PATIENT.	
History of scrofulous diathesis exists.	History of traumatism, rheumatism, syphilis, etc.

ACUTE ARTHRITIS.	CHRONIC RHEUMATIC ARTHRITIS. (*Rheumatic Gout.*)
PAIN.	
The pain is severe and acute in the early stages.	The pain is slight at first and increases with the development of the disease.
The pain is localized at the joint.	The pain is not local, but follows the course of nerve-trunks.
The pain is steady and constant.	The pain is paroxysmal and usually worse at night.
DEFORMITY.	
The deformity of the affected joint is at first due only to a serous effusion within it; but in latter stages structural changes occur.	The deformity is marked and progressive, resulting in the distortion of bony prominences, relaxed ligaments, atrophied muscles, etc., etc.
MOTION.	
The motion of the joint is frequently destroyed by suppuration.	The motion of the joint is usually only impaired, and a stiffness is experienced.
CREPITATION.	
Crepitation occurs from necrotic or carious changes within the joint, as the result of suppurative inflammation.	Crepitation, when present, is due to denuded cartilages, or a deposit of osteophytes.
AGE.	
This disease may occur at any age.	Occurs most frequently about 50th year of age.
HISTORY.	
Arthritis follows low vitality, exposure to cold or dampness, or traumatism.	This disease may follow high living, exposure, or injury.

ACUTE ARTHRITIS (*continued*).	CHRONIC RHEUMATIC ARTHRITIS (*continued*).
LOCATION.	
Is not confined to any special joints; is frequent in the ankle, knee, and hip.	*Attacks* the *hip* as a rule. In males it may affect any large joint, while in females the small joints are sometimes involved.

SYMPTOMS IN COMMON.

Both are associated with pain.
" " " " deformity.
" " " " crepitation.
" " " " impaired motion.

ACUTE ARTHRITIS.	SYPHILITIC PERIOSTITIS NEAR A JOINT.
SIGNS OF EFFUSION.	
The synovial pouches are prominent in the early stages of the disease.	No symptoms of effusion into the joint exist.
SWELLING.	
The swelling is generally diffused around the joint.	The swelling is localized, and often confined to one side of the joint.
PAIN.	
The pain is severe and acute from the commencement.	The pain is moderate in severity at the onset of disease.
The pain is steady and constant.	The pain always increases *at night.*
MOTION.	
The pain is affected by *motion* of the diseased joint.	The pain is not affected by motion of the joint.
SUPPURATION.	
Suppuration is frequent.	Suppuration is rare.
DISORGANIZATION OF JOINT.	
Disorganization of the joint is frequent.	The joint seldom becomes implicated or disorganized.
HISTORY OF PATIENT.	
A history of exposure, scrofula, or low vitality exists.	Evidences of syphilis are often detected in skin, bone, or organs.
EFFECT OF TREATMENT.	
Improvement slow under treatment.	Improvement marvellously rapid under iodide of potassium.

SYMPTOMS IN COMMON.

Both are associated with pain.
" " " " local swelling.
" " " " tenderness.
" may be " " suppuration.

ACUTE ARTHRITIS.	SUPPURATION EXTERNAL TO A JOINT.
APPEARANCE OF JOINT.	
The swelling present in the joint is bilateral.	The swelling in the vicinity of the joint is unilateral.
BONY PROMINENCES.	
The bony prominences normal to the affected joint are prominent in the early stages, unless complicating œdema exists.	The bony prominences of the joint are usually masked by the existing swelling in the vicinity of the joint.
SYNOVIAL POUCHES.	
The synovial pouches are prominent in the early stages, from serous distension.	The synovial pouches of the joint are not prominent.
FLUCTUATION.	
Fluctuation is often detected over the distended synovial pouches.	Fluctuation is detected at the seat of swelling, without regard to its particular location.
MOTION.	
Motion is impaired in the late stages by destruction of the mechanism of the joint.	Motion is often limited, but only by the mechanical impediments resulting from the swelling.
DISORGANIZATION OF JOINT.	
Disorganization of the joint is common and extensive.	Grating, crepitus, looseness of the joint and other signs of disorganization are absent.
CONSTITUTIONAL SYMPTOMS.	
The constitutional symptoms are marked.	No constitutional disturbance is present—as a rule.
MUSCULAR CRAMPS.	
Muscular cramps and *startings* in the sleep are prominent and severe.	No symptoms referable to muscular irritability are present.
TERMINATION.	
Frequently amputation is demanded.	Seldom of serious import.

SYMPTOMS IN COMMON.

Chills, pain on motion, unnatural attitude of joint, local heat, and swelling and tenderness on pressure are present *in both.*

BONY ANCHYLOSIS.	FIBROUS ANCHYLOSIS.
PAIN.	
No pain is produced within the joint by voluntary attempts at motion.	Pain is present if the patient makes strenuous efforts to effect motion in the anchylosed joint.
No pain at the joint results from manipulation in the hands of the surgeon, save at the direct points *compressed* by the fingers.	Marked and *severe* pain is experienced by any surgical attempts to produce mobility.
MOTION.	
All evidences of mobility are absent, and complete solidity exists.	The fixation of the diseased joint is incomplete.
EFFECT OF ANÆSTHETICS.	
Anæsthesia is negative in its results, as no perceptible motion in the joint can be thus produced, even under strong manipulation.	Anæsthesia frequently enables the surgeon to establish the normal latitude of motion, where it had previously been restricted.

II. DISEASES OF THE SPECIAL JOINTS.

DISEASE OF THE HIP-JOINT:

"*Morbus Coxarius.*"

By this term is designated all the various types of disease confined to the hip joint, which are liable to follow inflammatory changes within that joint, whether these inflammatory changes primarily affect the bone, the cartilaginous structure, or the synovial membrane.

By some authors a classification of *Morbus Coxarius* has been made into the Femoral, the Arthritic, and the Acetabular varieties, based upon the primary seat of origin of the inflammatory process.

In all of these types, however, we have *four prominent symptoms* which are common to all of the varieties, and which are liable to be present. They vary somewhat, however, in degree and intensity, with the location of the primary changes within the joint, and are for that reason often of aid in the diagnosis of the particular type of disease then existing.

These important symptoms are

1. Pain.
2. Suppuration.
3. Dislocation.
4. Anchylosis.

Other *common* symptoms also coexist in all of the varieties; among them may be mentioned

Deformity,
Lost or impaired motion and function,
Change in the appearance of the nates,
Change in the spino-pelvic angle,
Abnormal relation between the two anterior superior spines of ilium, especially when in recumbent position,
An antero-posterior curvature of the spine, and possibly a lateral deflection, when the limb is extended upon the trunk.

But these symptoms are diagnostic rather of the disease in general, than of any *particular seat of origin.*

In the following table will be shown in contrast those variations in the four above-mentioned symptoms, which will enable us possibly to detect the seat of the primary inflammatory changes within the joint.

Morbus coxarius is most frequently of traumatic origin; some blow, fall, wrench, or excessive strain having been experienced.

It is not infrequently associated with a scrofulous diathesis, which usually predisposes those so affected to inflammatory conditions, if any exciting cause be present; but it may also occur in subjects free from constitutional impairment.

It is most common in the young, and is seldom developed after the age of puberty.

ARTHRITIC.	ACETABULAR.	FEMORAL.
	1ST SYMPTOM: PAIN.	
Pain is *acute* from the onset of the disease, and is located *in the joint.* Is greatly increased by movement of the limb, concussion of femur, or pressure over the trochanter.	Pain at first is referred to the iliac fossa, or the side of the pelvis. Later on in the disease it becomes severe, and gnawing in character, and is referred to the joint itself. It is increased in all stages by concussion of femur, abduction of limb, or pressure over the trochanter.	Pain is referred to the *knee joint* in the early stages of the disease, and is often *slight* at the onset. This symptom is produced by irritation of the obturator nerve; which passes in close relation to the capsular ligament of the hip-joint, and which is, furthermore, distributed to it.
	2D SYMPTOM: SUPPURATION.	
Suppuration may possibly be absent.	An abscess of the intra-pelvic variety usually forms. It may point in front, above, or below Poupart's ligament;—or, by escaping through the sciatic notch, point behind, at the back part of the thigh.	Pus, when formed, burrows either under the glutei muscles, and points behind, or on the outer aspect of the thigh; or 2d, it burrows under the pectineus muscle, and points on the inner aspect of thigh.
	3D SYMPTOM: DISLOCATION.	
Dislocation is rare. When present, it is due either to rupture of the capsule, or caries of the head of the bone.	Dislocation into the pelvic cavity occasionally occurs from caries of the acetabulum.	Dislocation is frequent, and is due either to caries of the head of the femur, or new growth in the cavity of the acetabulum.
	4TH SYMPTOM: ANCHYLOSIS.	
Not infrequent; usually occurs within the acetabulum.	Anchylosis is rare.	Anchylosis often occurs in some abnormal position, following a dislocation of the femur.

The diagnosis of *morbus coxarius* in its early stages, before suppuration occurs, is of vital importance, as the prospect of complete recovery depends, as a rule, upon its early recognition.

The following *guides to its diagnosis* will therefore merit the closest attention:

1st. A change in the position of the affected limb and impaired function will exist in the earlier stages.

2d. The pelvis will be found inclined from a *right* angle to the spinal column, as shown by a line drawn between the two anterior superior spines of the ilium, and contrasted with the median line of the body. This pelvic inclination can, however, be restored to the normal position by manual pressure, or, possibly, by a muscular effort on the part of the patient.

3d. On placing the patient in the dorsal position upon the table, all attempts to *straighten* the affected limb until the popliteal space touches the table, will tend to elevate the back at the lumbar region from the same plane, so that frequently the hand can be placed between the table and the spinal column.

4th. In the same position on the table the two anterior superior spines of the ilium will be seen not to be on the same level as they are in health, when the limb is extended; the affected side being elevated above the healthy side.

5th. Flexion of the thigh and leg, and an altered relation of the affected thigh to the pelvis will remove the pelvic inclination, will bring the spines of the ilium to the same level, and will cause the lumbar region of the spinal column to lie in contact with the couch. When these points are perfectly accomplished the normal relations are restored, and the *actual existing deformity* of the hip is made manifest.

6th. Extension of the affected limb will usually relieve the pain by separating the inflamed surfaces of the joint.

7th. Concussion upon the end of the affected femur with the palm of the hand, when the knee is flexed, will increase the pain by approximating the inflamed surfaces.

8th. Pressure over the trochanter of the affected side will likewise, as a rule, increase the sufferings of the patient.

9th. Motion of the affected limb at the hip joint will usually give pain, and especially will this be marked when motion in some particular direction is attempted.

Great credit is due to Dr. Lewis A. Sayre, of New York, for the

present simplicity of diagnosis in obscure cases of *morbus coxarius*, as well as for his improvements in reparative appliances.

MORBUS COXARIUS is to be diagnosed from

1. Congenital dislocation of the hip.
2. Psoas abscess.
3. Disease of the sacro-iliac articulation.
4. " " trochanter of femur.
5. Lateral curvature of the spine.
6. Rheumatic deformity of the hip.
7. Disease of the crest of the ilium.
8. Inflammation of a psoas bursa.
9. Infantile paralysis.

CONGENITAL DISLOCATION OF THE HIP-JOINT.

This is a rare form of disease. It is apparently more frequent in females than in males, as the number of recorded cases shows over two-thirds to have existed in female children.

It has been found to result from one of the following conditions:

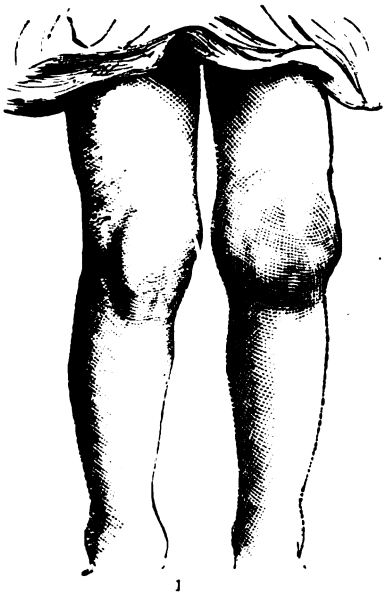
Abnormal *shortening* of the neck of the femur.
Abnormal *obliquity* of the neck of the femur.
Absence of the neck of the femur.
Partial or entire *absence of the acetabulum.*
Abnormalities in the *insertion* or *length* of the *round ligament* of the hip-joint.
Absence of the round ligament.

It is characterized by shortening of the affected limb at birth, and a prominence of the trochanter of the femur of the affected side. The motions of *abduction* and *rotation*, at the hip, are usually less free than on the healthy side; and the *tuberosity of the ischium* is rendered abnormally apparent by the drawing of the soft tissues over this bony prominence.

As the child acquires the power of walking, the *ball of the foot* only touches the ground, and the shortening of the limb is increased.

Many of the symptoms of this disease become much less apparent when the patient is in the recumbent position, and extension upon the leg reduces the deformity to a still greater degree.

PLATE V.



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1. Strumous synovitis. 2. Anchylosis with deformity. 3. Talipes calcaneus. 4. Talipes equinus. 5. Talipes varus. 6. Talipes valgus.

In advanced stages, the lower part of the trunk is usually thrown forward, while the thoracic portion is carried backward. Some lateral curvature of the spine may also result from the shortening of the affected limb. The points of diagnosis between this condition and morbus coxarius will be found contrasted in the latter pages of this chapter.

SACRO-ILIAC DISEASE.

The joint between sacrum and the ilium is seldom subjected to such a form of injury as to create local inflammatory changes. Some severe and peculiar form of injury, such as falling and catching by the feet, or slipping and having one leg retained in its position, is required to produce it. It is said to follow, in rare instances, a severe form of inflammation external to, or in the neighborhood of the joint.

In this condition, many of the symptoms revealed by examination are closely allied to those of morbus coxarius, provided the *ilia are not fixed* and rendered immovable. When this is insured, however, pain on concussion in the axis of the femur ceases, and all the motions possible to the hip-joint become free from pain; but, when the ilia are not made immovable, pain is present, if either of these tests is applied.

This disease is characterized by a limping gait, and an inclination of the body toward the side opposite to the affected joint.

Direct pressure over the *diseased joint*, if the patient be laid upon the abdomen, will *invariably cause pain.*

The affected limb is *actually lengthened*, but, as the alteration in length is above the hip-joint, the measurement from the anterior iliac spine to the internal malleolus, will be found identical on the two sides of the body.

A great point of diagnostic value is the absence of the development of abduction or eversion of the thigh, as the disease advances, which is so prominent a symptom of morbus coxarius. This is due to the fact that changes within the sacro-iliac joint, even if extensive, are not capable of influencing the coxo-femoral articulation. The eversion of the foot and abduction of the thigh occur prominently in disease of the hip-joint, since the capsular ligament of the hip, when distended with fluid, as it usually is in morbus coxarius, during the stage of effusion, is crowded to its utmost capacity, and the thigh necessarily assumes an *attitude which will best insure the greatest amount of space* within the capsule of the joint, viz., ab-

duction and eversion. It must be remembered, however, that this attitude of the thigh, which is of so great diagnostic importance in determining the existence of morbus coxarius, and in differentiating between it and sacro-iliac disease, ceases with perforation of the capsular ligament, when *adduction* of the thigh and *impaired mobility* will usually be detected.

The points of contrast between sacro-iliac disease and morbus coxarius will be found in a differential table in subsequent pages of this chapter.

MORBUS COXARIUS.	CONGENITAL DISLOCATION OF HIP.
PAIN.	
Pain is present as a symptom in all forms of the disease.	Pain is absent, the bone having an abnormal position, but being healthy.
EFFECTS OF PRESSURE.	
Pain is produced by pressure over the trochanter, or concussion of the femur.	Pain is often absent on both pressure and motion. Concussion may give *slight* pain.
SHORTENING.	
An *apparent shortening* of the affected limb appears early, due to tilting of the pelvis. Real shortening occurs, however, in the latter stages from absorption of the bone.	*Actual shortening* exists from the date of birth,—as shown by measurement from the ant. sup. spine of ilium, to the internal malleolus at ankle.
This shortening is not affected by upward pressure, after the muscles are firmly contracted.	This shortening can often be *increased* by upward pressure on the end of the femur.
EXTENSION OF LIMB.	
The apparent and real shortening are often *reduced* by extension.	The shortening of dislocation may often resist extension, and is seldom, if ever, completely reduced.
MOBILITY OF LIMB.	
The mobility of the limb is *greatly* impaired in late stages.	The mobility of the limb does not vary, and is usually free in character.
SPINAL COLUMN.	
A *spinal* deflection from contraction of the psoas muscle exists.	The spinal column is *normal.*

MORBUS COXARIUS (*continued*).	CONGENITAL DISLOCATION OF HIP (*continued*).
RELATION OF THE SPINES OF ILIUM.	
The anterior spines of ilium are not upon the same level when the patient lies upon the back.	The anterior spines of the ilium are upon the same level when patient is lying upon the back.

SYMPTOMS IN COMMON.

Both are associated with alteration in the length of limb.
" " " " pain on concussion.
" " " " impairment of the power of abduction of the limb.
" " " " impairment of the power of rotation.
" " " " abnormal attitude of the trunk.

MORBUS COXARIUS.	PSOAS ABSCESS.
History of Patient.	
No history of spinal disease can be elicited.	A well-marked history of spinal disease is present.
Pain.	
The pain at first is felt in the knee, hip, or pelvis.	The pain is usually referred to the back or loins.
Effects of Pressure.	
Pressure over the trochanter of femur usually causes pain, especially so after perforation of the capsule of the hip.	Pressure over the trochanter of the femur gives *no pain.*
Motion.	
Motion of the femur is painful in all stages of the disease.	Motion of the femur is *painless,* when the thigh is flexed to relieve pressure upon the tumor.
Fold of Nates.	
The fold of the nates is altered from its normal position.	The fold of the nates is normal in its position.
Length of Limb.	
The length of the affected limb is altered.	No change in the length of the affected limb can be detected.
Condition of the Joint.	
The joint is often immovable in advance stages, and there is an escape of pus.	The joint is movable, even after the abscess has discharged pus and established sinuses.

SYMPTOMS IN COMMON.

In both the contracted psoas affects the spinal curve.
" " " relation of the pelvis to the spine is often altered.
" " " evacuation of pus and the previous formation of a tumor in the thigh occur.
" " " pain and impaired function of limb may exist.

MORBUS COXARIUS.	SACRO-ILIAC DISEASE.
Effects of Position of Limb.	
The altered relation of the pelvis to the spine can be modified by the position of the limb.	The obliquity of the pelvis is not affected by the position of the limb.
Effect of Pressure.	
The pain on pressure over the trochanter is felt in the hip joint.	Pressure over the trochanter causes pain in the sacro-iliac articulation, but not in the hip joint.
Pain.	
The pain in the hip on pressure is not controlled by fixation of the os innominatum.	The pain on pressure and motion is modified, or entirely controlled by fixation of the os innominatum.
Length of Limb.	
A change in the length of the limb affected is often present.	The lengthening of the limb is actual, but not apparently so, if measurement be made from the anterior spinous process of the ilium to the inner malleolus at the ankle-joint.

SYMPTOMS IN COMMON.

Both may be associated with local pain.
" " " " suppuration and the formation of sinuses.
" " " " obliquity of the pelvis.
" " " " detection of necrosed or carious bone, by the probe.
" " " " apparent lengthening of the limb on affected side.

MORBUS COXARIUS.	DISEASE OF THE TROCHANTER OF THE FEMUR.
AGE AFFECTED.	
Is chiefly a disease of childhood.	Occurs chiefly during adult life.
HISTORY.	
Occurs, as a rule, after some injury, as a fall, severe strain, or blow.	Follows rheumatism, gout, syphilis, or some blood diathesis.
APPEARANCE OF NATES.	
The fold of the nates is abnormal in its position.	The fold of the nates corresponds with that of the opposite side.
PAIN IN KNEE.	
A pain in the knee is often a prominent and an early symptom.	No pain in the knee, or inner aspect of the thigh, is ever present.
APPEARANCE OF SPINE.	
The spine is usually curved from contraction of the psoas.	The spine is usually normal in appearance.
POSITION OF PELVIS.	
The pelvis is usually tilted.	The pelvis is usually normal.

SYMPTOMS IN COMMON.

Both are associated with pain on motion of the femur.
" " " " " " pressure over trochanter.
" " " " formation of abscess and sinuses.

MORBUS COXARIUS.	LATERAL CURVATURE OF THE SPINE.
NATES.	
The fold of the nates is abnormal in position.	The fold of the nates is unaltered.
LENGTH.	
The length of the limb is often altered on actual measurement.	No *real* alteration in the length of the limb is ever present.
PAIN.	
Pain is present on pressure over the trochanter, or on concussion of the femur.	No pain is produced by pressure over the trochanter, or by concussion of the femur.
ABSCESS.	
Symptoms of abscess appear, followed by the escape of pus and the formation of sinuses.	No symptom of abscess, or of the evacuation of pus occurs.
SPINAL DEFORMITY.	
The spinal deformity, produced by contraction of the psoas muscle, is reduced by position of the limb.	The spinal deformity is not affected by position of the femur.

SYMPTOMS IN COMMON.

Both are associated with apparent shortening.
" " " " altered pelvis.
" " " " " spine.
" " diseases of childhood.

MORBUS COXARIUS.	RHEUMATIC DEFORMITY OF HIP.
AGE.	
Is a disease chiefly of childhood.	Seldom exists in the young.
HISTORY.	
Is preceded by a history of injury; and most frequently occurs in scrofulous or weak children.	Is preceded by a history of rheumatism.
NATES.	
The fold of the nates is abnormal in position.	The fold of the nates corresponds with its fellow.
LENGTH OF LIMB.	
The length of the limb is usually altered.	The length of the limb is usually normal.
ABSCESS.	
Abscess and sinuses are common symptoms.	Abscess is rare.
COMPLICATIONS.	
No disease is present simultaneously in other joints.	Other joints are, as a rule, simultaneously involved.

SYMPTOMS IN COMMON.

Both are associated with impaired motion.
" " " " possible immobility.
" " " " " crepitus.
" " " " pain on pressure.
" " " " " " motion.

MORBUS COXARIUS.	DISEASE OF THE CREST OF ILIUM.
LENGTH OF LIMB.	
The length of the affected limb is abnormal, as a rule.	The length of the limb on the side affected corresponds with its fellow.
MOTION OF LIMB.	
The motion of the affected limb is either impaired or lost.	The motion of the limb is normal on the side affected.
ABSCESS.	
The abscess resulting from the diseased joint opens, as a rule, *below* the level of the upper border of the trochanter of the femur.	The abscess resulting from disease of the ilium points and evacuates itself *above* the level of the hip joint.
PROBE.	
A probe when introduced usually detects carious bone at the hip, after suppuration has occurred and the abscess has discharged.	A probe when introduced finds the seat of carious or necrotic changes to be above the articulation.
SHAPE OF THE HIP.	
The shape of the hip is abnormal; and the nates are dissimilar.	The hip is normal in appearance; and the nates on each side correspond.

SYMPTOMS IN COMMON.

Both are associated with marked pain.
" " " " the formation of abscess.
" " " " sinuses, in later stages.
" " " " low vitality and emaciation.
" may occur in the young.

MORBUS COXARIUS.	INFLAMMATION OF A PSOAS BURSA.
SHAPE OF HIP.	
The hip is altered in its shape and appearance.	The hip is normal in shape and appearance.
FOLD OF NATES.	
The fold of the nates is displaced on the affected side.	The fold of the nates is similar to that of the opposite side.
EFFECT OF PRESSURE.	
Pain on pressure over the trochanter is perceived.	Pressure over the trochanter of affected side gives no pain.
KNEE SYMPTOMS.	
Symptoms referable to the knee appear early.	Symptoms referable to the knee are absent.
TUMOR.	
The tumor due to the pointing of pus appears late in the disease, and is usually painless to the touch.	The tumor produced by the inflamed bursa appears early, is located in the anterior part of the thigh, and is *painful* to the touch.

SYMPTOMS IN COMMON.

Both are associated with flexion of the affected limb.
" " " " pain on motion of the limb.
" " " " impaired, or restricted function in the joint.
" *may* be associated with pelvic distortion.
" " " " " spinal curvature.

MORBUS COXARIUS.	INFANTILE PARALYSIS.
Length of Limb.	
The shortening *may*, in some cases, be apparent only; while in some stages even lengthening may exist.	The shortening of the affected limb is actual, as shown by measurement from anterior spine of ilium to the inner malleolus of ankle.
Spinal Curvature.	
The spinal curvature is more of an antero-posterior character, as it depends greatly upon contraction of the psoas muscle.	The spinal curvature which often exists is of the lateral variety.
Size of Limb.	
The affected limb may be normal in size.	The affected limb is atrophied and smaller than its fellow, provided one limb only be affected.
Suppuration.	
Suppuration and the formation of abscess are common.	Abscess is seldom if ever present, save as a complication.
Mobility of Joint.	
The joint is often immovable in the third stage of the disease.	The joint is never fixed or immovable.
History of Patient.	
A history of injury followed by pain in the knee, etc., is present.	A history of sudden loss of muscular power is present, in the majority of cases.

SYMPTOMS IN COMMON.

Both may be associated with alteration in the length of the limb.
" " " " " spinal curvature.
" " " " " atrophy of the limb.

Diagnostic Points of Tenderness on Pressure in Inflammation of the Larger Joints.

All joints, when inflamed, or when an increased amount of synovial fluid is present, present certain special localities where an abnormal degree of sensitiveness to pressure exists. This local sensitiveness, if detected early, often confirms a diagnosis.

I have enumerated below the anatomical situation of those diagnostic points which pertain to the five principal joints of the body.

In the Hip.	*Close behind the trochanter*, the fingers being shaped like a cone, and firm pressure made.
" " Knee.	*On either side of the patella.*
" " Ankle.	*In front of the joint, slightly above the malleoli.*
" " Shoulder.	*The anterior aspect of the joint*, pressure being made through the axillary coverings.
" " Elbow.	*In front of the joint*, over the head of the radius.

III. DEFORMITIES OF JOINTS.

The various deformities of joints which are liable to be met with in a surgical practice, may be divided into, 1st, those of congenital origin; and, 2d, those acquired after the date of birth.

Under the first type, viz.: "Those deformities which are congenital," may be enumerated

A. Congenital Distortions; under which I include

1. Club Foot, in all its varieties.
2. Club Hand, in all its varieties.
3. Sub-Luxation, in all its varieties.
4. Distortions, dependent on paralysis.
5. " " " contracted muscles.

B. Congenital Malformations; under which head may be enumerated

1. Atrophy of limb, with malformation of long bones.
2. Hypertrophy of phalanges.

3. Atrophy, or absence of phalanges.
4. Imperfect development of carpus, metacarpus, tarsus, or metatarsus.
5. Fusion of toes or fingers (syndactylus).
6. Valgoid malformation of upper extremities.
7. Supernumerary toes, digits, or even entire members.
8. Fusion of inferior extremities ("sympodia;" "monopodia").

Under the second type, viz.: "ACQUIRED DEFORMITIES OF JOINTS," may be enumerated

1. Deformities from wounds, accidents, rheumatism, and diseases of joints.
2. Deformities from rickets, weakness and curvature of bones.
3. Deformities from muscular contraction.
4. " " " paralysis.
5. " " burns.
6. Spinal curvatures and deformities.

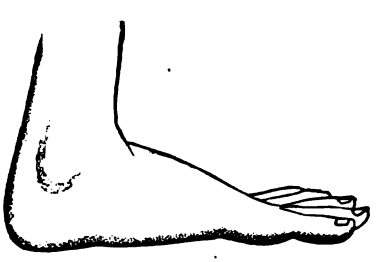
Many of the types of malformations which exist under the congenital variety, have been omitted, as they have no direct bearing upon the JOINTS. They are seldom of such a character as either to demand surgical diagnosis, which is usually self-evident, or to be benefited by surgical treatment. To those interested, however, in such deformities, I refer, for reference, to Henle's classification of Congenital Malformations.

I pass to the consideration of *Club-foot* as the most frequent, and, possibly, the most important congenital deformity of the joints.

TALIPES.

By "Club-foot," or "Talipes," is meant an abnormal condition of the tarsus, and frequently of the metatarsus, resulting in an altered relation of the axis of the limb to the axis of the foot.

PLATE VI.



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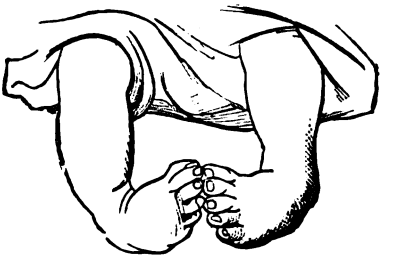

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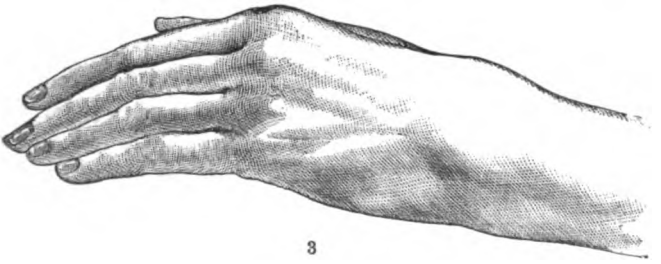

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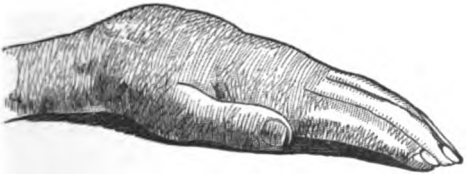

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1. Splay- or flat-foot. 2. Severe form of double Talipes varus. 3. Arthritis deformans (early stage). 4. Same in advanced stage. 5. Medio-tarsal deformity in contrast with the normal attitude. 6. Scrofulous synovitis of ankle. 7. Arthritis of wrist and ostitis. 8. Mild form of double Talipes varus.

It is usually divided into the following varieties:

TALIPES. 8 distinct types.

1. Talipes Equinus.....where the heel is raised and the foot extended upon the leg.
2. " Calcaneus.....where the heel is projecting and the foot flexed.
3. " Varus.....where the sole of the foot is turned inward.
4. " Valgus.....where the sole of the foot is turned outward.
5. " Equino-Varus....where a combination of the equinus and varus deformities exists.
6. " Equino-Valgus...where a combination of the equinus and valgus deformities exists.
7. " Calcaneo-Valgus..where a combination of the calcanean and valgus deformities exists.
8. " Spurio-Valgus....or "Flat-foot," where the plantar arch is deficient.

Of these types, the *combined varieties*, especially those of the Equinus type, can hardly be considered otherwise than as the simple varus or valgus deformity associated with contraction of the muscles forming the tendo Achillis, and consequent elevation of the heel.

The Gastrocnemius, Soleus, and Plantaris muscles, which form the tendo Achillis, are important factors in the varus deformity, being adductors of the foot as well as extensors. It is seldom, therefore, that Talipes varus fails to escape some elevation of the heel, although the term Equino-varus is not applied until this altered position of the heel becomes a marked element in the deformity.

Talipes can hardly be confounded with any other deformity. I therefore confine the few following pages to its individual types only; my object being rather concisely to record the diagnostic points of each, than to infer the possibility of error in diagnosis.

TALIPES VARUS.	TALIPES VALGUS.
Frequency.	
As a congenital disease, this deformity is the most frequent form of talipes.	As a congenital deformity, Talipes Valgus is *rare*.
Deformity, if Congenital.	
The foot is *adducted*, the sole turned inwards, or upwards, and the internal malleolus is obliterated.	The foot is *abducted*, the sole turned outwards and often upwards, and the external malleolus is obliterated.
Progress of the Deformity, if Acquired.	
The disease, if *acquired* after birth, is first manifested by elevation of the internal border of the foot, from contraction of the two tibial muscles and the muscles of the tendo Achillis.	The disease usually first reveals itself by an elevation of the external border of the foot, due to contraction of the peronei muscles, the long extensors of the toes and the muscles of the tendo Achillis.

SYMPTOMS IN COMMON.

Both are associated, if of long standing, with stiffness in the ankle joint.

" " " " " " " a longitudinal furrow in the sole of the foot, from narrowing of the transverse arch of the foot.

" " " " " " " a slight elevation of the heel.

" " " " " " " the gradual formation of a soft, cushiony swelling on the *dorsum* of the foot where the pressure of walking occurs.

" " " " " " " rigidity of tendons on the side of deflection of the foot.

TALIPES EQUINUS (*simple*).	TALIPES EQUINUS, with paralysis of the extensor muscle of the toes *and flexors of the tarsus.*
Position of the Foot in Walking.	
The patient walks upon the ends of the metatarsal bones.	The patient walks upon the dorsum of the foot, which is bent upon the ground with the sole looking backwards and upwards.
Attitude of the Toes.	
The toes are drawn upwards.	The toes are relaxed or flexed.
Muscular Power.	
The muscles on the anterior part of leg can partly control the foot and the toes.	All flexion of the foot and extensor-muscular power over the toes are lost.

SYMPTOMS IN COMMON.

Both are associated with absence of any *lateral* displacement.
" " " " increased width of the foot, from separation of the metatarsal bones.
" " " " projection forward of the astragalus.
" " " " elevation of the heel.
" " " " contraction of the muscles of the calf.
Both may occur in the young, and, possibly, in the adult.

TALIPES VALGUS (Spurious).	TALIPES, CALCANEO-VALGUS OF MODERATE SEVERITY. (The Chinese foot as example.)
Plantar Arch.	
The arch of the sole of the foot is *diminished.*	The arch of the sole of the foot is *increased.*
Insteps.	
The instep is less prominent than normal.	The instep is increased in prominence.
Length of Foot.	
The front part of the foot is normal in its length.	The anterior portion of the foot is much shortened.
Muscles of Calf.	
The muscles of the calf are normal in size, and the *tendo Achillis* is prominent.	The muscles of the calf are atrophied, and the *tendo Achillis* is scarcely visible.
Outer Margin of Foot.	
The outer edge of the foot becomes elevated as the disease advances.	A *deep cleft* exists on the outside of the foot at the peroneus longus tendon, but the outer edge of the foot is *not raised.*

SYMPTOMS IN COMMON.

Both are developed, as a rule, after birth.
" " progressive in deformity.
" " associated with altered gait.
" " " " abnormal appearance of outer margin of foot.

TALIPES VALGUS.	TALIPES, SPURIO-VALGUS ("FLAT FOOT").
AGE.	
Is present at date of birth as a comparatively *rare* affection.	May commence in early life, but seldom becomes a deformity till adolescence.
ORIGIN.	
It may be acquired, however, from infantile paralysis, convulsions during dentition, standing too long on feet, carrying heavy weights, etc.	If occurring after 18th year of age, is due to rheumatism, excessive standing or walking, or general *debility*.
DEFORMITY.	
The external margin of the foot is elevated, the foot is twisted so that pressure falls upon the internal malleolus and inside of the instep, and the metatarsus and toes do not touch the ground. No projection of the astragalus, or widening of the foot is present.	The tarsal arch is destroyed through relaxation of the calcaneo-scaphoid ligaments, and those between the scaphoid, and the cuboid and internal cuneiform bones. The astragalus projects in front, the foot is widened, and the convexity of the dorsum of the foot is lost.
LENGTH OF FOOT.	
The length of the foot is diminished, and the toes are often flexed.	Eversion of the toes, and actual *elongation* of the foot occur.
ANKLE JOINT.	
The motion within the ankle joint is rapidly impaired.	The *ankle joint* remains useful for a time, but gradually loses its capabilities of motion.
OUTER MARGIN OF FOOT.	
The outer margin of the foot is affected early in the disease, and locomotion is performed on the side of instep.	The outer margin of the foot becomes raised *late* in the disease, and locomotion is mostly effected upon the heel, in the later stages.

TALIPES VALGUS (*continued*).	TALIPES, SPURIO-VALGUS ("FLAT FOOT") (*continued*).
PAIN.	
The pain is of an unimportant character and is often absent.	Pain exists *previous* to the complete breaking down of the plantar arch at the internal malleolus and the sole of the foot from tension on the ligaments; but it ceases when full deformity is reached. This pain is more severe in slight cases than in severe ones.
EFFECT OF STANDING.	
The act of standing increases the deformity in a slight degree in the early stages, but the normal attitude of joint is not re-assumed, even in the recumbent position.	In the early stages the plantar arch is effaced on standing, but returns when the weight is removed.

TALIPES, SPURIO-VALGUS ("FLAT FOOT").	SPRAIN OF ANKLE JOINT.
PAIN.	
The pain in the early stages is confined to the internal malleolus and the *sole* of the foot.	The pain is usually within the joint, or at either malleolus, and is seldom if ever present in the sole of the foot.
HISTORY.	
No history of sudden wrench or twisting of ankle is present, but rather of prolonged exertion or debility.	A history of some sudden or severe exciting cause exists.
SWELLING.	
No swelling, with tenderness to the touch, exists in vicinity of the ankle.	Swelling and tenderness are marked in the vicinity of the ankle joint.
EFFECT OF STANDING.	
A marked alteration in the plantar arch appears from the weight of the patient when standing.	No alteration in the shape of the foot ensues from the standing position.
RESULTS.	
Gradual deformity ensues, unless recognized early, and preventive treatment employed.	Gradual improvement and restored function follow.

SYMPTOMS IN COMMON.

Both are associated with pain in the ankle.
" " " " pain on standing or walking.
" may be " " a history of excessive exertion or debility.
" " " " long duration and progressive symptoms.

DISEASES OF BONE.

DISEASES OF BONE.

THE diseases, which are confined to the bony structures of the body, are frequently relieved by surgical measures only, and are properly classed as essentially *surgical* conditions.

As an enumeration of the various types of diseases of bone liable to be encountered, I would present the following table:

A. INFLAMMATORY DISEASES OF BONE, comprising:
   1. Simple inflammation of bone—OSTEITIS.
   2. Diffuse suppurative inflammation of the interior of the bone—OSTEO-MYELITIS.
   3. Circumscribed suppuration of bone—ABSCESS OF BONE.

B. INFLAMMATION OF THE COVERINGS OF BONE, comprising:
   1. Simple inflammation—PERIOSTITIS.
   2. Suppurative " —PERIOSTEAL ABSCESS.
   3. Chronic " —PERIOSTEAL THICKENINGS and NODES.

C. GRADUAL CHANGES IN, OR ABNORMAL DEVIATIONS FROM THE HEALTHY TYPE OF BONE STRUCTURE:
   1. Atrophy of bone.
   2. Hypertrophy of bone.
   3. Rachitic condition of bone.
   4. Mollities ossium.
   5. Caries of bone,—or ulceration of bone.
   6. Necrosis of bone,—or gangrene of bone.
   7. Spontaneous fracture.
   8. Tumors of bone.

THE TUMORS OF BONE may be divided into two types:

A. *Non-malignant* tumors, including
   1. Enchondromata.
   2. Exostoses.

3. Cystic.
4. Fibrous.
5. Fibro-cystic.
6. Entozoa.

B. *Malignant* tumors, including

1. Pulsatile tumors of bone.
2. Cancer of bone, 3 types: { Colloid, Encephaloid, and Scirrhus.
3. Malignant cysts—"Spina Ventosa."

In accordance with the method pursued in previous chapters of this work, each of these conditions will first be separately described before the symptoms of the more important diseases are contrasted in tabular form. It will be perceived, however, that, in the diseases of bone, the *etiology* and the *history of the patient* are of particular importance, since, in most of the conditions above mentioned, the initial symptoms are often vague and difficult to positively locate, and, in many cases, they are precisely similar.

It has been the endeavor of the author to render these descriptions as concise as is consistent with the character of the work, and yet to furnish all the essential points required for a diagnosis.

OSTEITIS.

This condition is one of simple inflammation, and is, as a rule, dependent upon *external violence* or *exposure to cold* as *exciting* causes; although some *predisposing* causes can usually be detected, such as rheumatism, syphilis, scrofulous taint, or defective nutrition from local or constitutional conditions.

It is most frequent in those bones which are the most exposed, and is, therefore, commonly found in the tibia, the bones of the skull, the sternum, the ribs, and the bones of the hand and foot.

It is not an uncommon affection, and is often present when the disease is supposed to be confined to the periosteum only. The obscurity of its early symptoms often prevents its early diagnosis, and, especially so, if they are masked by the accompanying symptoms of some injury, which has been its exciting cause.

Osteitis is usually accompanied, in its early stages, by pains in the affected bone, which are increased by dampness, and which usually exacerbate in the night. The bone rapidly loses its normal power of resistance to pressure, on account of the absorption of the

mineral elements of the bone, and a fatty change within its animal constituents; and an *increase in its volume* also occurs from exudation and from periosteal thickening.

An *apparent increase* in the size of the affected bone is due, often, to a simultaneous œdema and induration of the soft tissues which surround it; and care should be used to determine how much of the enlargement depends *solely upon the bone itself*, since, if markedly developed, it is a valuable guide in the diagnosis of this disease.

The *softening* can rarely be positively detected, as it seldom involves the whole thickness of the bone, and seldom, therefore, alters its form; while the extreme sensitiveness of the soft tissues renders firm pressure unendurable by the patient. It may also be often rendered incapable of detection by œdema of the soft tissues.

The symptoms of osteitis, from this point in its progress, are modified by the character of the inflammatory process. *Suppuration* may develop, if the case is one of the acute type, or hardening of the bone or *sclerosis* may occur, if the case be one of chronic inflammation, by a deposit of lymph in the bone interstices, which subsequently ossifies.

In many cases, resolution however occurs without either of these processes being developed.

Osteitis is to be diagnosed from inflammations either of the periosteum or of the soft tissues which surround the bone. The points of discrimination will be found arranged in the form of diagnostic tables in the latter pages of this chapter.

OSTEO-MYELITIS.

This term is applied to a diffuse suppurative inflammation of bone tissue. It is closely allied to pyæmia, if acute in form, and is, as a rule, rapidly followed by a fatal termination. It is often unrecognized during life, as it usually is produced by and accompanies an injury, whose symptoms often mask the graver disease.

This disease is seldom unassociated with some form of injury, such as contusions over bones which are superficially situated, compound fractures, amputations, gun-shot wounds, etc., etc.

The changes in the bone consist of an infiltration of the medullary and cancellous portions with pus, gangrene of the endosteum, central necrosis, and greatly increased vascularity of the bone and the lining membrane of the medullary canal. Changes in the soft tissues about the seat of injury may also be detected, as the result of the diseased condition of the osseous structures.

The symptoms of this disease are frequently obscure in the early stages, and, later on, they are often masked by the symptoms produced by the inflammation of the surrounding soft tissues. The occurrence of *rigors*, marked *exacerbations of temperature*, and frequent *sweatings*, if following an injury which has opened the medullary cavity of a bone, are symptoms of the gravest import.

The partial or complete cessation of the discharge from the wound, and the *loosening of the periosteum* and its *recession* from the bone, can usually be detected; and a pain of a severe character, which is diffused throughout the diseased bone, is a valuable diagnostic symptom. The recession of the periosteum and the soft tissues, especially in cases where this disease follows amputation, often leaves the end of the bone as a projection from the stump. Necrosis of the exposed portion rapidly follows, and reamputation of the member is often demanded, if pyæmic symptoms should be still absent, but, if present, surgical relief is no longer possible.

Osteo-myelitis may be of a chronic type, in occasional instances, and progress to the development of a sequestrum of necrosed bone without the occurrence of pyæmic symptoms, if the disease be localized; or, if the disease be diffuse in character, amputation may be demanded as the only remedy for a source of irritation which would otherwise prove fatal.

Osteo-myelitis is to be confounded only with osteitis, and their symptoms will be found contrasted in a diagnostic table in the closing pages of this chapter.

ABSCESS OF BONE.

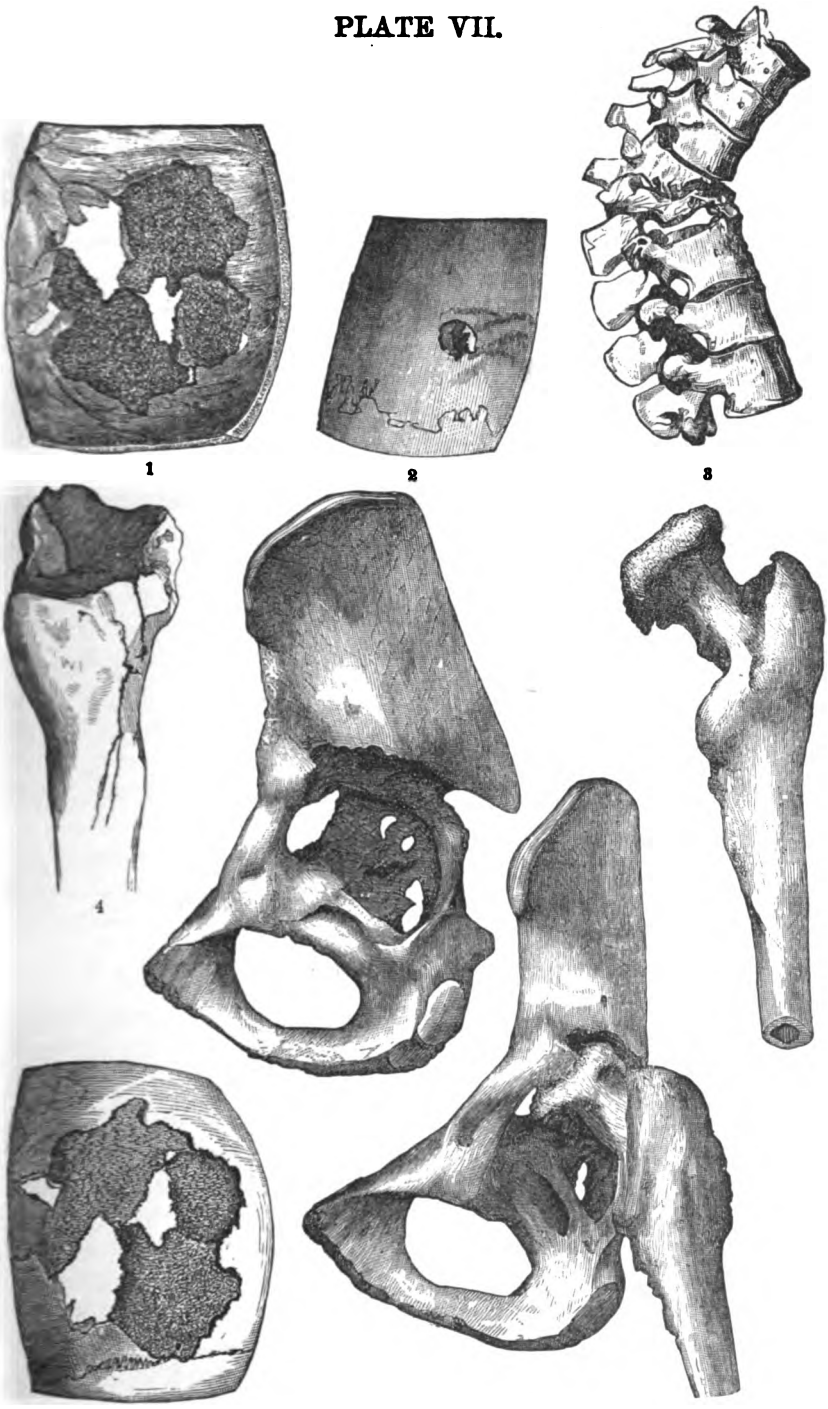
This condition is one of *circumscribed suppuration* of bone tissue, and differs from the disease just described (osteo-myelitis), in its causation, its course, its extent, its rapidity, and its termination.

The first description of this disease is credited to Sir Benj. Brodie, to whose admirable investigations we are chiefly indebted for the knowledge now afforded us as to the symptoms and course of this obscure affection.

This disease is most frequently situated in the *articular extremities* of some of the long bones of the body, and chiefly in the region of the knee, ankle, and elbow. Of all the separate bones of the body, the *tibia* is most frequently affected in its upper extremity.

The cause of this disease is often obscure, but it is probably produced by some form of injury received at a time more or less remote from the date of appearance of the first symptoms. It is affected,

PLATE VII.



1 and 6. Necrosis of skull-cap. 2. Puncture of skull-cap. 3. Caries of vertebræ. 4. Articular disease following fracture. 5. Caries of acetabulum and femur.

without question, by local and constitutional causes, which impair the vigor of the part, and possibly by climatic conditions.

The symptoms of this disease may be, at first, simply a *dull pain*, which is worse at night, and which is increased by exercise and by pressure. This pain may also manifest a tendency to remissions and exacerbations, but this is also frequent in all diseases of the bone and periosteum, where pain is an early symptom.

The tenderness on pressure is *distinctly localized*, as the disease advances, and its *persistency* and *long duration* are points of value in discriminating it from the superficial tenderness of a localized periostitis, which is characterized by swelling, even in its early stages, and by a rapid development or an equally rapid subsidence.

As the disease progresses, a tumefaction of the soft parts over the inflamed bone appears, which is subsequently followed by the discharge of pus externally, and the formation of sinuses; unless the abscess chance to extend towards the articular surface of the bone and involve the joint. In this latter case, the symptoms of an approaching synovitis will indicate the effect of irritation of the structures of the joint by the encroaching pus, and, if neglected until the rupture actually takes place, the condition becomes a most serious one.

The establishment of *free drainage* of the cavity by the trephine or the chisel often prevents, if done in time, this most serious complication.

Abscess of bone is to be differentiated from synovitis or arthritis of the neighboring joint. The points of contrast between it and these diseases will be found in the closing pages of this chapter.

PERIOSTITIS.

The periosteum may be affected by inflammatory processes of a *simple*, *suppurative*, or *chronic* type. In the *simple form*, although the disease may be essentially acute in its development, the tendency of the inflammatory process is towards the formation of either a lymph deposit, or a cell growth which is not sufficiently rapid to induce suppuration, from its inability to organize.

In the *suppurative* or the *diffuse type* of periostitis, the inflammatory process is more extended, and the cell proliferation is so rapid that organization cannot take place, and pus therefore forms and accumulates between the bone and its periosteal covering, often destroying the nutrition of the bone by tearing off the periosteum, and thus inducing superficial necrosis.

In the *chronic type* of the disease, the tendency is towards thickening of the periosteum at the seat of the inflammatory process,

which is, as a rule, distinctly localized; and, often, to the formation of osseous nodes, by means of changes in the thickened periosteum.

Periostitis, in all of its forms, is frequently the result of some form of injury, and it is therefore most liable to affect the long bones, and those which are superficially situated. It may, however, follow syphilis, scrofula, rheumatism, mercurial poisoning, and gonorrhœa.

The *diffuse* or *suppurative type* of the disease is usually of traumatic origin, but it is, furthermore, associated, as a rule, with some impairment of constitution or hereditary taint. Its importance rests in its tendency towards rapid and extensive progress, and in the danger of necrosis of the bone from the separation of the periosteum by the accumulated pus. It is characterized by great pain, marked constitutional disturbance, diffuse cellular inflammation of the soft tissues, fluctuation after pus forms, and by being confined between two joints. It is most common at about the age of puberty, and usually affects the long bones. It is to be diagnosed from suppuration of the tissues external to the bone, from suppurative erysipelas, from acute rheumatism, synovitis, and arthritis. In severe cases, pyæmia may develop and prove a source of immediate death.

The *chronic form* of periostitis is most frequently present in syphilis, and it most commonly affects the anterior surface of the tibia. It is associated with severe pain in the region of the seat of the disease, with tumefaction dependent on swelling of the periosteum, with extreme tenderness to pressure, and with exacerbations at night and during damp weather.

The swellings upon bones affected with chronic periostitis are called *nodes*. If situated upon the tibia, they show a marked tendency to ossify; although when present in other parts of the body they may closely *simulate* the hardness of bone, without any evidence of ossific granules being detected after death.

Periostitis is seldom unassociated with some inflammatory condition of the adjacent bone, except in that form where syphilis is the exciting cause.

HYPERTROPHY OF BONE.

As an evidence of the close vital relation between the soft tissues of the body and the bony structures, the conditions of hypertrophy and atrophy of bone are of great surgical interest.

Hypertrophy of bone is an augmentation of healthy bone tissue, in contradistinction to inflammatory induration of bone. It occurs both in long bones and those which are chiefly composed of cancellous tissue, as the bones of the face.

If *long bones* be affected, the circumference is more often increased than the length, although the latter may, in exceptional cases, be markedly increased. The tibia and the fibula seem to be the most frequently affected of all the long bones, and reported cases of an increase of three inches over the normal length of these bones, as well as a proportionately increased circumferential measurement, are on record.

In the *face*, the superior maxillary is the bone which is most liable to undergo hypertrophy, and, in severe cases, the orbit, the nasal cavity, and the antrum may be seriously encroached upon.

A form of hypertrophy of bone which is *circumscribed*, and which results in the formation of osseous swellings upon the bone involved, occasionally occurs; and the tumors so formed differ from true exostoses only in the absence of a fibrous or a cartilaginous stroma, as revealed by a microscopical examination.

Hypertrophy of bone is *unaccompanied by pain*, and is exceedingly *slow in its progress*, often extending over a period of many years. It may, however, be accompanied by superficial exfoliations of bone, if the newly formed bone is poorly nourished, and also by signs of inflammation of the adjacent structures. If the long bones of the lower extremity be hypertrophied in their *length*, the gait may be impaired, and suspicion may be created of either existing or of previous disease of some neighboring joint.

Local enlargements of bone, *dependent* upon *true hypertrophy*, are found at the points of insertion of tendons, at the ends of bones where amputation has been performed, on the bodies of the dorsal and lumbar vertebræ, and, in advanced life, on the bodies of the cervical vertebræ. They can only be differentiated, during life, from the different forms of tumors of bone, by the absence of some of the special symptoms of other forms of tumors, or by the absence of an exciting cause; and, after death, by a microscopical section.

ATROPHY OF BONE.

This condition is one of actual diminution in the size of a bone from its previous or normal point of development. It may progress to so great an extent as to render the affected bone comparatively hollow, like the bones of a bird, or the bone may present a simple decrease in its size without any apparent alteration in its microscopical structure. It is much more frequently met with than hypertrophy of bone, and possesses a greater clinical significance.

This condition depends, to a great extent, upon some cause

which creates either decreased blood-supply to, or defective nutrition of, the part. It may follow *lack of use*, as occurs in paralysis, or after amputation in certain regions; *anchylosis* of a joint, which is complete and of long standing; *congenital defect in a joint*, which impairs its utility; *abscess* in the affected bone, through stasis produced in the vessels, or from the pressure created; *rickets*, which seems to influence the development of bones in their *length* rather than in their circumference; and, finally, *deficient heart power* and *general weakness*, without the existence of any actual disease being detected.

Atrophy of bone is often the cause of *lameness*, where the long bones of the lower extremity are deficient in length; and, in this condition, a lateral curvature of the spine may be created by the attitude assumed by the patient to obviate the effects of the shortening.

In cases of *excessive salivation* in early life, non-development of the inferior maxillary bone is liable to occur from the injury done at that time to the soft parts, in which the bony structures seem subsequently to sympathize, although the bone may not have been directly involved to any marked degree at the time of the accident.

Atrophy of bone may occasionally follow the occurrence of a *fracture;* and if so, it is probably produced by some injury to the nutrient artery.

Cases are on record of apparent atrophy of bone, in its length, being produced by a separation of the epiphyseal cartilages. Such a condition is to be explained only as an evidence of the suspension of growth between the shaft of the bone and the epiphysis, which has become detached.

RACHITIC CONDITION OF BONE—RICKETS.

By this term is defined a condition of body which usually appears between the seventh month and the seventh year of life, and which is characterized either by an absence of the normal amount of mineral deposit within the bones, or, in certain localities, by an excessive deposition of earthy salts in the bony structures.

It has been explained as the result of an *excess* of *lactic acid* in the blood, which holds these salts in solution, and thus favors their excretion by means of the kidneys; also on the ground that a *diminished supply of chalky salts* is afforded from defect in the character of the food; and, finally, it is regarded as a direct result of an *inflammatory process* in the epiphyseal cartilages and the periosteal coverings of the affected bones. In some instances there appears to be a *hereditary predisposition* to the disease which favors its development.

Rachitic bones are distorted either by *angular deformity*, by *curvatures*, or by *local enlargements*. The *angular* deformities are most common at the diaphyses of bones; the *curvatures*, at the epiphyses, and at the points of cartilaginous union of those bones which have not epiphyses; while the *local enlargements* are mostly due to a widening of the transverse diameters of the epiphyses of the long bones.

The *action of muscles* upon those bones, which are affected by the rachitic condition, often becomes a powerful agent in producing the varieties of deformity above mentioned; and many of the others are due, in a great measure, to the *weight* of the *head* and *trunk*. *Atmospheric pressure* is, without doubt, also a prominent factor in producing that deformity of the sternum and chest to which the term "chicken-breast" is vulgarly applied, and the other deformities of that region are often *secondary* to curvature of the spinal column.

In the head, the *sutures*, which are analogous to the epiphyses of the long bones, are slow to ossify, and the fontanelles are late in closing. The deposit of earthy salts is imperfectly performed at the *centres of ossification*, and thinning of the bones occurs in these localities, which often allows the dura mater and the periosteum of the skull to come in contact, thus forming the condition called *cranio-tabes*.

In the region of the pelvis, the *antero-posterior diameter* is shortened at the expense of the transverse diameter, the sacrum is altered in its curve, and the sacro-vertebral angle is rendered prominent. The cordiform or heart-shaped pelvis is also often produced by a curvature at the point of junction of the pubis with the ischium.

In the *long bones*, besides the curvatures and angular deformities previously mentioned, the *medullary canal* is often compressed at the seat of deformity, and the bone may, in extreme cases, become so thinned as to cause a spontaneous fracture.

During the process of resolution from an attack of rickets, a tendency towards the too *rapid ossification* of the enlarged epiphyses of the long bones seems to be developed, and thus the further growth of these bones is seriously interfered with. This possibly accounts for the dwarfish stature of adults who have been victims to a rachitic condition in infancy. The late closure of the sutures and the small development of the facial bones, in proportion to that of the skull fully ossified in adult life, renders the appearance of the head also conspicuous.

The *premonitory symptoms* of rickets are often of great diagnostic value, and may be thus enumerated. Disposition of the child to *lie quiet* when previously playful, a *tendency to cry* at any attempt at motion; *general hyperæsthesia* of the skin, as shown by crying on being handled; a tendency towards a *chronic intestinal catarrh*, as shown by a yeast-like diarrhœa; *profuse sweatings* and a *dislike to covering* during sleep.

The *actual symptoms* of the disease first manifest themselves by the appearance of *enlargement of the epiphyses* of the long bones, which is most noticeable at prominent and superficial joints, as the knee and elbow. If this symptom appears before attempts at walking have been made, much of the later deformities of the long bones may be avoided, although the condition of *cranio-tabes* is more liable to be produced in those attacked during the first year of age.

During the existence of rickets, the symptoms of a *chronic bronchial catarrh* are seldom absent, the *teeth* are cut at a date long after the normal period, the body *emaciates* rapidly, the *sitting posture* is no longer straight, since curvature of the spine usually commences at an early date, and the *deformities* of the *chest* and *extremities* are gradually developed.

When rickets attacks children who have reached the age of three or four years, the initial symptoms of pain, hyperæsthesia, etc., are generally absent, and a sense of muscular weariness after exertion is the first evidence of the disease, before the tendency towards deformity of the long bones begins to manifest itself.

Rickets, being essentially a disease of childhood, can hardly be mistaken in diagnosis after the tendency towards deformity is markedly developed.

Its symptoms, however, will be found tabulated in the closing pages of this chapter.

MOLLITIES OSSIUM. (*Malacosteon, Fragilitas Ossium, Osteo-Malacia.*)

These terms are used to express abnormal conditions of bone, where either actual softening or a brittle condition is developed. They are classed and described together, as it is questionable if they are not, properly speaking, different phases of the same disease, and dependent upon the same general set of causes.

These conditions are generally those of adult life, and are more frequently present in the female sex than in males. They may be associated with some form of constitutional disease, prominent

among which may be enumerated the rheumatic diathesis, secondary or tertiary syphilis, and scurvy.

These conditions are not to be confounded with the atrophy of bones which occurs normally in advanced life, or with carcinomatous disease of the bones; since they differ from the first, in being often fatal diseases, and, from the second, in not being localized, as a rule, but affecting the whole skeleton to a greater or less extent. Moreover, the pathological conditions found in these two diseases differ markedly from that of carcinoma or of simple atrophy, in the very large proportion of fatty matters contained in the bones affected, and in the alterations of the normal appearance and arrangement of the bone substance.

Mollities ossium is regarded by some as rickets attacking the adult, by others as a true fatty degeneration of bone, and finally by some as closely allied to cancer. It is a disease rarely met with, and the exact pathology and etiology of it are still matters more of theory than of absolute knowledge. In some reported cases, a marked hereditary tendency seems to have existed, while in others a previous history of rickets during childhood was present.

As a result of these changes within the bony structures, a tendency either to *progressive deformity* or of *fracture* of bones from trivial causes is developed. Frequently several fractures may occur almost simultaneously, or, if the bone be rendered rather flexible than brittle, the long bones and those of the pelvis will become bent and twisted to a marked degree.

The form of pelvic deformity produced by mollities ossium differs from that produced by rickets, in that the *transverse* diameter is shortened in the former, from pressure of the thigh bones against those of the pelvis, while, in rickets, the antero-posterior diameter is generally decreased. It has been observed, that if the various foldings of a pelvis, distorted by mollities ossium, could be unfolded, that the pelvis would again have its normal shape and size, while, in the rachitic pelvis, the parts would be of dwarfish size, and of undue shapes and proportions.

Mollities ossium is to be differentiated, during life, from rickets, simple atrophy of bone, and from cancer. The points of contrast will be found in the closing pages of this chapter.

CARIES OF BONE.

This condition is sometimes called *ulceration of bone*, since it is analogous to ulceration of the soft tissues. It is essentially an *inflammatory process*, although of *low grade*, and its primary seat is

usually the cancellous bone structure. It may be superficial or central in its situation, and is most frequent in the *articular extremities* of long bones, if centrally located.

It is met with in scrofulous subjects, in syphilis, or in other conditions of low vitality; and it may also follow injury, or an extension of inflammation from other parts to the neighboring bone.

It consists of a *molecular* death of bone tissue, in contrast to the condition of necrosis, which consists of the death of bone tissue in mass, and not in molecules. It is associated, sooner or later, with inflammatory changes in the soft tissues, and the formation of abscess and sinuses.

If the ulcerative process be superficially situated, the periosteum becomes loosened from the surface of the bone, and thickened and altered in its structure.

Carious bone is easily broken down by the pressure of a probe, and yields to the touch a *grating sensation*, similar to that perceived on rubbing an instrument over sand-paper. This peculiar sensation is a point of diagnostic value in the discrimination between caries and necrosis.

The symptoms of caries are, at first, those of a low grade of inflammation, and comprise *constant pain* in the neighborhood of some bone, *swelling*, more or less *impairment* of *function*, and the *symptoms of abscess* over the affected portion. Later on in the disease, a constant *escape of pus*, having a putrefied and offensive odor, the formation of *sinuses*, and the development of *granulations* at the mouth of the sinus, which gives it a pouting or elevated appearance, are indicative of the irritation produced by the diseased bone upon the surrounding parts.

A positive diagnosis of caries is only revealed, however, by probing, when the absence of extreme sensitiveness, and the detection of a grating surface, which is soft, and which bleeds readily, is pathognomonic; in case the direction of the sinuses will admit of the introduction of the probe to the seat of the disease.

In some cases, *light percussion* over the affected part is of diagnostic value, as a sharp pain is experienced by the patient similar to that perceived when injury is done to a carious tooth.

In the condition, described as *abscess of bone*, the cavity in which the pus is contained is formed, to a great extent, by carious degeneration, which is liable to continue after the pus is evacuated.

Caries of bone is to be diagnosed chiefly from necrosis. The points of contrast between these diseases are appended in the form of a table in the closing pages of this chapter.

NECROSIS. (*Gangrene of Bone.*)

By this term is meant the *death of bone tissue in mass*, and not in molecules. It is analogous to gangrene of the soft tissues.

This condition is one essentially of the *compact tissue* of bone, since that part of the bone, which is the least vascular, is most liable to be the primary seat of gangrene when the nutrition of the part is either impaired or totally arrested.

The causes of necrosis may all be grouped under the head of agents, which impair or totally arrest the blood-supply of the affected part. Thus the causes may be made to include both those *local causes*, which interfere with the nutrition of bone, such as separation of the periosteum, traumatisms, escharotics, exposure to cold, thrombosis or embolism of the nutrient artery or some of its branches, acute osteitis, etc., etc.; or they may also embrace those *constitutional conditions*, which so alter the character of the blood as to impair its life-giving properties, and thus to predispose to gangrene of the bony structures in those situations where the blood is, in health, but scanty, and which immediately feel any influence which tends to impair its nutrition. These constitutional conditions which predispose to necrosis are too numerous to individually mention, but they include all the fevers, scrofulous conditions, syphilis, cancerous cachexia, poisoning from mercurials, phosphorus, ergot, the condition of scurvy, etc., etc.

The changes which are induced in a bone, where the nutrition is locally or generally impaired to a serious degree, may be summarized in the following stages:

1st. *Death of the bone*, as indicated by its white color, unless it be exposed to the air, when it becomes darker, its insensibility, the absence of vascularity, and the existence of a hard denuded surface which emits a sonorous sound when struck with an exploring probe.

2d. *Inflammation* of the *surrounding tissues*, from the irritation produced by the dead bone, which has now become a foreign body. This inflammatory process in the soft tissues leads to suppuration, and its subsequent evacuation, and the formation of sinuses, which present the pouting appearance at their mouths, mentioned as present also in caries, and which is due to the process of exuberant granulation as a result of the irritating character of the pus which is constantly exuded. In this inflammatory process, the periosteum also participates; and it becomes loosened from the affected portion of the bone and perforated with openings to allow of the escape of

pus into the sinuses through the soft tissues. These sinuses, leading from the surface to the seat of necrosis, are called *cloacæ*.

3d. *Separation* of the *necrosed portion* of the bone now occurs, and the term *sequestrum* is applied to the loosened piece of bone. The sequestrum may not be always movable, however, as it is often held in its original position by bands of newly formed bone which are poured out by the detached periosteum. This process of detachment of the necrosed bone is often a very slow process, and may extend over a period of months.

4th. *Gradual extrusion* of the *sequestrum* now occurs from pressure produced by the development of newly-formed bone granulations, underneath the sequestrum, which are destined subsequently to replace the necrosed portion, and to which the term *involucrum* is applied. This process is, in some cases, rendered impossible, as the sequestrum is retained by newly formed bone; but, if the necrosis be superficial in its situation, Nature, even when unassisted, will remove the dead portion of the bone, although the process must of necessity be a slow one.

5th. A *modelling* of the *involucrum* into the normal shape of the bone, after the sequestrum has been either artificially removed or extruded, generally takes place, and the bone thus regains its normal strength and often its normal appearance.

Necrosis may be divided, on a basis of its location and extent, into three varieties, viz.: *superficial*, when on the surface; *central*, when imbedded in the bone beneath the surface; and *total*, when the whole thickness of the bone is involved.

The symptoms of necrosis are but little at variance with those of caries, save that, in superficial necrosis, the suppuration is more rapidly developed and the symptoms of onset more marked.

In *central necrosis*, deep-seated pain, throbbing, rigors, general debility, tumefaction over the seat of the disease, and some pain on pressure are usually present. In some cases, acceleration of the pulse and temperature may likewise be detected. In this condition, surgical relief affords the only prospect of recovery, as the extrusion of the sequestrum is an impossibility.

Some general idea of the extent of the disease may be formed, as a rule, by the number and situation of the sinuses; as they usually bear a direct relation to the amount of necrosis present.

CANCER OF BONE.

The bony structures may be affected by the various forms of

cancer either as a primary disease, or as a secondary result of cancer in some region, more or less remote from the bone attacked.

All *malignant tumors* of bone are not necessarily *cancerous* in their nature, as they may lack the characteristic microscopical appearance of epithelial growths; thus those cysts, called spina ventosa, as well as some forms of pulsatile tumors of bone, often manifest great malignancy, although they may have none of the microscopical appearances of true carcinomatous structure.

No bone in the body may be said to be exempt from cancerous disease, but the femur is, by far, the most frequently attacked, and the long bones of the leg are more commonly selected than those of the upper extremity, the cranium, spine, or pelvis.

Cancer of bone seems also to select the immediate neighborhood of joints as its most frequent situation, and it may commence either as a disease of the periosteum or of the bone structure. It is to be differentiated from tumors of the non-malignant type, chiefly by the length of their period of development, and their slow and indolent course; also by the presence of glandular complications, which seldom exist in innocent tumors, and subsequently by the large size, the soft consistence, and the unequal density of different parts of cancerous tumors, by the marked increase in the size of the superficial veins, the extent of their attachment to the bone, and the pain with which their growth is attended and often preceded.

In the diagnosis of cancer of bone, a careful examination of the glandular organs of the body for symptoms of a similar condition, and the general appearance of the patient, who will often give evidence of the effect of the disease upon the general system by the peculiar cachexia, which is often pathognomonic, will help greatly to render a positive conclusion possible.

OSTEO-ANEURISM.

This term is applied to *pulsatile tumors of bone*, since, by some, these tumors are believed to be analogous to aneurism of the arteries situated in the soft tissues. The name is often, however, a *misnomer*, since these pulsating tumors are sometimes exceedingly malignant in their character, and are therefore not truly aneurismal in their origin.

This form of tumor springs from the cancellous tissue of the bone affected, and, by a process of absorption, expands until it protrudes beyond the limits of the bone, and yields a distinct pulsation which often renders the exclusion of true aneurism difficult. It is to be differentiated from cancer and from aneurism of a neighboring

artery. The points of contrast between these diseases will be found in the closing pages of this chapter.

NON-MALIGNANT TUMORS OF BONE.

These include a group of tumors which affect the bony structures, and which are composed, in some instances, of the same structures as the bone itself. In others, although the structure of the tumor may differ greatly from that of bone, and in this respect they may resemble the malignant tumors in their composition, still they give evidence of no malignant tendency in their progress or development, and, for that reason, must be classed under a different heading.

The six varieties of non-malignant tumors which affect the bones have already been mentioned in the first pages of this chapter, and need not be here repeated. The points of diagnostic importance pertaining to each, will, however, be separately considered, although they will be found, in many instances, arranged in the form of contrast in the closing pages of this chapter.

ENCHONDROMA.

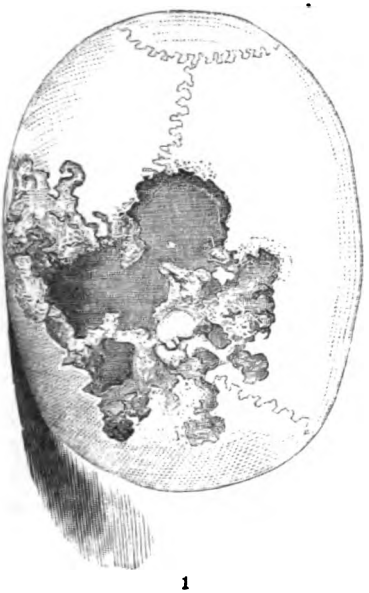
Cartilaginous tumors are usually associated with more or less ossification, and can rarely be found exempt from more or less evidence of malignancy in their origin and development. They may be circumscribed, when a state of *complete ossification* of the new growth will occasionally be found, or diffuse, when the cavities of the bone are, as a rule, completely filled, and the infiltration of the bony structures extends over a large extent of surface, and is seldom associated with more than a state of *partial ossification*.

True cartilaginous tumors of bone differ, however, from cancerous growths in one marked peculiarity, viz.: that they affect surrounding parts only to the extent attributable to the pressure created by them, while cancer rapidly infiltrates the neighboring structures. This point is, however, of less diagnostic value, during life, than would, at first, be supposed, since the rapidity of growth of enchondromatous tumors is usually slow.

The seat of these tumors is chiefly confined to the *phalanges* of the *fingers* and *toes*, but, in occasional instances, they attack some of the larger long bones. Solitary enchondromatous tumors are not infrequently met with upon the *last phalanx* of the *great toe*, and a great source of inconvenience in wearing a boot is thus occasioned.

The only surgical relief to be obtained, in case of the development

PLATE VIII.



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1. Necrosis of skull. 2. Malignant tumors of the femur and tibia. 3. Large sequestrum. 4. Deformity of malacosteon. 5. Central necrosis and involucrum. 6. Deformity of malacosteon. 7. Necrosis with osteo-myelitis.

of tumors of this type, lies either in the removal of the growth, in case it be situated so as to render such a procedure practicable, or in the amputation of the diseased part.

EXOSTOSIS.

Under this term, should properly be included only innocent tumors of bone, of a limited size, having a structure analogous to that of the bone from which it springs, and formed independently of any inflammatory condition which may have existed, either in the bone itself or in the periosteum, before the occurrence of the tumor.

Such a definition, however, might exclude many forms of osseous growths, which are commonly described as true exostoses, since it is questionable if inflammatory action does not precede the larger proportion of circumscribed enlargements of bone, even if their course of development be a slow one, and their symptoms those of a benign character. In chronic rheumatic arthritis, the tendency toward the production of masses of new bone is one of the *chief characteristics* of that disease, and it is as positively proven that these masses become joined to the original bone and so thoroughly incorporated with its structure as to be a source of annoyance only from the mechanical irritation which may be the result of their presence, rather than from the character of the growths themselves.

Local inflammations of the *periosteal covering* of bone may also, in some cases, produce a product which may completely ossify and subsequently coalesce with the original bone. It is quite probable, however, in spite of these occasional methods of origin, that the large majority of exostoses are a variety of local hypertrophy of the bone elements, and are independent of any inflammatory causation. These cases are to be explained as analogous processes in bone to those in the softer structures, where fatty, fibrous, and other innocent tumors are developed without any apparent exciting cause.

Exostoses are of two varieties, as regards their microscopical structure, viz.: the cancellous and the ivory-like growths. The former of these seems to be a reproduction of the central portion of a bone, and the latter the reproduction of the external or compact layer.

The *ivory-like tumors* are found most frequently upon the bones of the cranium, and are of such extreme hardness that steps for their removal have often proved useless from the inability of the cutting instruments to affect their structure.

The *cancellous variety* of exostoses are probably preceded by a *cartilaginous formation* and a subsequent process of ossification within

it. They are found in other situations than the cranial bones more often than the preceding variety, and are much less dense in their structure. They are most frequently situated upon the long bones of the extremities, especially in the femur at its lower portion.

Exostoses of the cranium are to be differentiated from tumors disconnected from the bone, and from the other forms of bone tumors. If situated in the region of the orbit or the frontal sinuses, they may be overlooked until some marked evidence of their presence is made manifest by abnormal conditions of the neighboring organs or by some abnormality of the bony contour of the adjacent regions.

Exostoses, even if small, often create serious symptoms by pressure upon important structures. Thus, if growing from the first rib, the subclavian artery may be displaced or compressed; if affecting the lower cervical vertebræ, the same result may ensue, and cases of gangrene of the upper extremity are on record from such interference with the supplying vessel; in both of these situations, the œsophagus may be pressed upon, and dysphagia will then be produced. Cases of growths from the odontoid process have caused spinal softening, and even fatality, from the direct pressure created. In the pelvis, growths from the pubic bones may cause retention of urine and subsequent organic changes in the bladder.

The causes of exostosis may be summarized as follows:

(1.) Blows or external injuries.
(2.) The effect of muscular strain at the seat of its bony point of attachment, especially if a process of bone normally exists at this point.
(3.) A peculiar ossific diathesis, tending to induce excessive osseous development from slight exciting causes.
(4.) A perversion of the normal nutritive processes, from inflammatory conditions of the bone or of its periosteal covering, from fracture of the bone, chronic rheumatic arthritis, etc.

True exostoses should not be an indication for surgical interference, unless some mechanical effect is produced upon surrounding parts which tends to disturb the proper performance of their normal function.

CYSTIC TUMORS OF BONE. (*Osteo-Cystoma.*)

Cysts of bone may be of two varieties, viz.: serous and sanguineous. The *serous cysts* are sometimes called *mucous cysts*, as the

contents are often of a glairy or a gelatinous character, and resemble mucus in its appearance and consistence.

True cystic tumors of bone are most frequently developed in the *region of the jaws*, and are often the result of an abnormal growth or position of the teeth. They enlarge by creating an expansion of the bony structures, and by a gradual absorption of the bone from the pressure which they cause upon the nutrient vessels of the part.

Cystic tumors of bone are not to be confounded with those cysts which accompany hydatids, although the two may not be capable of differentiation during life; except as is stated by some authors, any situation may be regarded as opposed to the development of true cysts, if not confined to the region of the face.

In the closing pages of this chapter, the symptoms of cysts, in the region of the antrum, will be found arranged in contrast with those of solid tumors of that portion of the face.

The *sanguineous form* of cyst, which occasionally affects bones, is a rare type of disease, and, in the few reported cases on record, seems to be closely allied to either cancer or some of the malignant forms of bony tumors. By some authorities, however, this form of tumor is regarded as analogous to a hæmatoma of bone, and is explained as the result of some form of external violence, which has injured the cancellous bone tissue, and thus predisposed to rupture of the vessels of the bone. It would seem, however, that this theory is not well sustained, in the majority of cases, as the date of an injury previously received is often separated from the date of the appearance of the tumor by a long interval; while, in other cases, no history of traumatism can be detected.

The diagnosis between the two varieties of cystic tumors of bone can be made, after fluctuation can be detected, by the exploring needle, which will disclose the character of the contents of the cyst.

FIBRO-CYSTIC TUMORS. (*Osteo-Sarcoma.*)

This form of disease is of rare occurrence, and is often confounded with cancer. It may, however, prove itself, in some cases, an innocent form of tumor, and cannot therefore be properly classed under either innocent or malignant tumors of bone. These tumors may affect almost any part of the human skeleton, and are not always capable of diagnosis during life, as they are often associated with many symptoms which tend to create a suspicion of malignant growth. Their name is indicative of the microscopical appearance which renders the diagnosis positive, as the presence of fibrous

tissue in large quantity stamps the tumor as not one of the ordinary cystic tumors of bone.

FIBROUS TUMORS OF BONE.

The most typical illustrations of this variety of tumor are found in the *fibrous polypus* of the nasal cavity and in *epulis*, which is situated within the mouth. This form of tumor seems to develop as an outgrowth of the periosteal covering of the bone affected, and is closely allied to the enchondromatous and the myeloid types of disease.

In this form of tumor, the symptoms are usually of a benign character, except in case of epulis, where the tumor occasionally takes on ulcerative action and assumes a tendency toward the development of fungoid growth.

ENTOZOA OF BONE.

Hydatids have, in a few reported cases, been found to exist in the bony structures to such an extent as to render the affected part a cause for surgical interference. The variety of hydatid present is usually that developed from the echinococcus.

In this condition, the course of the disease is a very gradual one, and if a long bone be affected in its shaft, the first evidence of the condition may be afforded by the occurrence of a *spontaneous fracture*, or one possibly associated with some slight form of injury.

This disease may not be confined to long bones but may be present in the flat bones also. Cases have been reported where the bones of the cranium and the os innominatum have been the seat of extensive diseases.

In case of fracture of bone from the presence of hydatids within its substance, *all evidence of attempts at union* are usually wanting, and the disease has in some cases been detected during attempts to produce union by exposure and refreshing of the fractured ends of the bone.

Hydatids of bone cannot usually be detected during life, since they are slow in development, and are often unproductive of symptoms, unless their existence is made manifest by fracture.

OSTEITIS.	OSTEO-MYELITIS.
ORIGIN.	
It may result from disease, or from traumatism.	Is always traumatic in origin; follows amputations, fractures, etc.
It occurs in scrofula, syphilis, rheumatism, and follows exposure.	It occurs, as a rule, where the medullary canal is exposed to the air.
MOST FREQUENT SEAT.	
The tibia, bones of the head, and ribs are most frequently affected.	The long bones are most frequently involved.
PAIN.	
The pain present is *intermittent;* is worse at night if syphilitic in origin, or is increased by dampness if of rheumatic origin.	The pain is first perceived at the seat of injury, or in the stump in cases where amputation has been performed, and is accompanied by *rigors.*
CHANGES IN THE BONE.	
The affected bone gradually enlarges in circumference.	Pyæmic symptoms often rapidly follow, associated with high fever, dryness of the stump, or arrested secretion at the seat of injury, if caused by fracture. The soft tissues are also often retracted.
The bone becomes hard, irregular in contour and incompressible.	The bone undergoes necrotic changes and becomes infiltrated with pus.
TERMINATION.	
The disease often terminates in recovery.	Recovery is rare.

SYMPTOMS IN COMMON.

Both may be associated with a traumatic history.
" " " " marked pain.

CARIES.	NECROSIS.
Definition.	
Is a molecular death of bone tissue, and is analogous to ulceration of the soft tissues.	Is a death of bone tissue in mass, and not in molecules, and is analogous to gangrene of the soft tissues.
Is a disease which affects the cancellous tissue of bone.	Usually attacks the compact tissue of bone.
Most Frequent Seat.	
Is most frequent in the articular extremities of long bones.	Is most frequent in the shafts of long bones.
Etiology.	
Always results from a low grade of chronic inflammation, as in scrofula, syphilis, injury, or an extension of inflammation from other parts.	May be traumatic in origin, and acute; is always due, however, to *defective nutrition* of the bone tissue.
Sinuses.	
Sinuses form slowly, as the disease is not often superficial in its early stages.	Sinuses form rapidly after the death of the bone has occurred.
Cavities in Bone.	
Tends to create cavities within the bone.	Is usually superficial and seldom results in the formation of central cavities within the bone.
Probe Examination.	
A fine, grating sensation alone is detected by the probe on examination.	A smooth, denuded, and frequently loose sequestrum is detected by the probe

SYMPTOMS IN COMMON.

Both may be associated with prolonged suppuration.
" " " " " sinuses.
" are " " abnormal sensations on probing.

OSTEITIS.	PERIOSTITIS.
PAIN.	
The pain which exists is *deep*, and diffused throughout the bone.	The pain is superficial in character, and usually circumscribed.
TUMOR.	
The bone undergoes a *uniform* enlargement.	The bone develops a local tumor.
SENSITIVENESS.	
The bone affected is moderately sensitive to pressure.	Extreme sensitiveness to pressure exists over the affected portion.
CAUSATION.	
Is frequently the result of simple exposure.	Is usually either traumatic or syphilitic in origin.
RESULTS.	
Amputation is frequently demanded in severe types.	Amputation is seldom required, as the disease usually subsides under treatment, or goes on to abscess and necrosis.

SYMPTOMS IN COMMON.

Both are associated with pain in the region of the bone affected.
" " " " enlargement of the bone.
" " " " sensitiveness to pressure.
" " " " constitutional disturbance often.
" " " often with traumatic history.

PERIOSTITIS NEAR A JOINT.	ACUTE ARTHRITIS.
EFFUSION.	
No symptoms of effusion into the joint exist.	Symptoms of effusion within the joint are prominent.
SWELLING.	
The swelling is localized, and often confined to one side of the joint.	The swelling about the joint is generally uniform, and always bilateral.
PAIN.	
The pain is moderate in severity at the onset of the disease.	The pain is severe and acute from the commencement.
The pain usually increases at night.	The pain is steady and constant.
PAIN ON MOTION.	
No pain is produced by motion of the affected joint.	Great pain is often associated with motion at the diseased joint.
SUPPURATION.	
Suppuration is rare.	Suppuration is frequent.
DISORGANIZATION OF THE JOINT.	
The joint seldom becomes implicated or disorganized.	The joint rapidly undergoes disorganization, unless the disease be arrested.
SYPHILIS.	
Evidences of syphilis are often detected in the skin, bone or organs.	No evidences of syphilis are detected, as a rule.
RAPIDITY OF IMPROVEMENT.	
The improvement under the iodide of potassium is often marvellously rapid.	An improvement is only produced by local measures.

SYMPTOMS IN COMMON.

Both are associated with swelling near the joint.
" " " " pain.
" " " " abnormal sensitiveness to pressure.

ABSCESS OF BONE.	ARTHRITIS.
Motion.	
The motion of the neighboring joint is seldom affected.	The affected joint early manifests pain when certain movements are demanded.
Swelling.	
The disease is not externally revealed until *late*, being, as a rule, exceedingly slow in its progress.	The size of the joint increases and becomes prominently affected in the *early* stages.
Pain.	
The pain is usually deep seated in the neighborhood of a joint, but not within it.	The pain is located *within* the joint and is usually steady and constant.
Suppuration.	
When the circumscribed pus reaches the surface the joint is seldom involved, but a continued escape of pus through a sinus is liable to remain indefinitely until the cause be relieved.	When suppuration occurs the joint usually undergoes rapid disorganization.
Appearance of Tissues.	
Often normal over seat of disease till the pus reaches the surface.	Venous congestion, œdema, and a boggy condition of the soft tissues are often present.
History.	
Is of slow and insidious development, as a rule.	May develop rapidly, and is always preceded by marked local symptoms.

SYMPTOMS IN COMMON.

Both are associated with pain in the vicinity of a joint in the early stages.
Both may be associated with suppuration.
" " " " " sinuses in late stages.
" " " " " the detection of carious bone by probing.

RICKETS.	MALACOSTEON. OSTEO-MALACIA.—MOLLITIES OSSIUM.
TIME OF ORIGIN.	
Rickets commences, as a rule, in infants from the sixth month to the close of the second year. It is rare after puberty.	A softening of bone which occurs after puberty, usually in middle life, or as age advances.
DEFORMITY.	
The long bones of the body become twisted or bent.	The disease may affect the whole bony system, or only portions of it.
The flat bones become hypertrophied in their cancellous structure, especially at their edges, and a softening is frequent at the centres of ossification.	The pelvis and the spine are its frequent seats.
	The stature is often greatly diminished, if the legs or spine be affected.
The face is often undeveloped in proportion to the cranium.	The facial bones are seldom affected, and the proportion to the cranium is normal.
Spinal curvatures are frequent, and pelvic deformities with shortening of the antero-posterior diameters.	The pelvic deformities are characterized by shortening of the transverse diameters, but the bones are normal as to development.
The bones of the thorax become deformed from spinal changes and muscular action.	
The bones affected are often arrested in development.	The bones affected are normal in size and appearance before the attack.
DIATHESIS.	
Rickets is frequently associated with a scrofulous diathesis.	No scrofulous diathesis, but a rheumatic history is frequently present, the disease seeming to consist in a fatty degenerative process.
TERMINATION.	
The disease frequently ends in recovery, and does not necessarily tend to shorten life.	The disease seldom tends towards recovery. May prove fatal, from complications, within a few years.

SYMPTOMS IN COMMON.

Both result in deformities of the bony structures.
" are due to impairment of normal health.

EXOSTOSES OF BONE.	CYSTS OF BONE ("SPINA VENTOSA").
SITUATION.	
Most frequently affect flat bones and the shafts of long bones.	Most frequently affect the jaw and the articular heads of long bones.
SHAPE.	
Are usually globular in shape, but they may be pediculated.	Are usually round or oval in shape.
SIZE.	
Are of moderate dimensions.	Are often immense in size. They may reach the size of a child's head.
NUMBER.	
Are frequently multiple.	Are usually single.
PALPATION.	
Are hard and incompressible.	Crackle like parchment, in the late stages, when the bone is thinned.
DEVELOPMENT.	
Develop slowly and regularly.	Develop rapidly, as a rule, but often irregularly; often being slow in growth and then suddenly rapid, or *vice versâ*.
FLUCTUATION.	
The tumor never fluctuates.	Fluctuation exists in localized spots during the advanced stages.
CONDITION OF VEINS.	
The superficial veins are normal.	The superficial veins are enlarged.
PAIN.	
No pain on pressure exists, as a rule.	Pain is often present on firm pressure.

SYMPTOMS IN COMMON.

Both are associated with a local tumor of bone.

" " " often with symptoms referable to irritation of nerves, muscles, joints, or vessels.

CANCER OF BONE.	PULSATILE TUMORS OF BONE.
Locality of Tumor.	
The disease affects the articular heads of long bones, especially the lower end of the femur.	The tumor occurs in the line of some vessel.
Condition of Tumor.	
The tumor is hard, irregular, incompressible and painless in early stages.	The tumor is irregular in shape, and painful.
Consistence of Tumor.	
The tumor becomes elastic and fluctuant in spots during the advanced stages.	The tumor is of uniform consistence.
Rapidity of the Growth.	
The tumor grows rapidly and often attains immense size.	The tumor grows slowly.
Effects of Pressure.	
The tumor is not affected by pressure, or by impeded vascular supply.	The tumor is modified in size and appearance by impeded circulation, through pressure on the supplying vessel.
Mobility.	
The tumor is immovably attached to the bone.	The tumor can often be partially separated from the bone.
Appearance of Veins.	
The superficial veins are markedly enlarged.	The superficial veins are normal in appearance.
Pain.	
Pain is deep, lancinating, and constant, early in the disease.	Pain is slight, and is rather an *uneasy* feeling than severe.

CANCER OF BONE (*continued*).	PULSATILE TUMORS OF BONE (*continued*).
PULSATION.	
Pulsation is detected late in the disease, and is often absent.	Pulsation is detected early.
FUNGOID.	
"Fungoid excrescences" are frequent.	No tendency to fungoid growth exists.
CACHEXIA.	
A marked cachexia exists.	No cachexia is apparent.
The neighboring glands are often involved.	The neighboring glands are normal.

SYMPTOMS IN COMMON.

Both are common in *young people.*
" pulsate.
" are indicated by a tumor.
" may produce pain.

PULSATILE TUMORS OF BONE.	ANEURISM.
Mobility of Tumor.	
The tumor is firmly attached to the bone.	The tumor is movable.
Palpation of Tumor.	
Osseous plates are felt in the walls of the sac.	The walls of the tumor are felt to be soft and uniform in consistency.
The edges of the tumor are osseous.	The tumor is soft, elastic and compressible throughout.
Pulsation.	
The pulsation within the tumor is indistinct, and not markedly expansive.	The pulsation within the tumor is distinct, and *expansive* in character.
Outline of Tumor.	
The outline of the tumor is indistinct.	The outline of the tumor is often distinct.
Effects of Pressure.	
The tumor is only slightly affected as to size or appearance by direct pressure or impeded arterial supply.	The tumor is markedly decreased in size, and altered in appearance by direct pressure upon it, or by obstructing its circulation by pressure upon the supplying vessel.

SYMPTOMS IN COMMON.

Both are associated with a tumor.
" " " " pulsation.
" " " often with symptoms referable to irritation of joints, nerves, muscles, or vessels.

SPECIAL TYPES.

ABSCESS OF ANTRUM.	SOLID TUMORS OF ANTRUM.
DEFORMITY.	
The antrum is equally distended.	The antrum is *unequally* distended.
INFLAMMATORY SYMPTOMS.	
Acute *inflammatory symptoms* are present, such as : Chills, Great pain, " sensitiveness to touch, Œdema of face, Increased pulse, and " temperature.	No acute inflammatory symptoms are present (such as pain, œdema, great sensitiveness and constitutional disturbance).
FLUCTUATION.	
Fluctuation often appears in advanced stages.	Fluctuation is absent, as a rule.
DISCHARGE INTO MOUTH OR NOSE.	
A tendency to the discharge of pus through the teeth sockets, or through the nostril during forced expiration, or in certain positions of the body exists.	No tendency towards a spontaneous discharge of the contents of the cavity of the antrum is apparent.
EXPLORING NEEDLE.	
The exploring needle in cases of doubt decides the diagnosis.	The exploring needle gives negative results.

SYMPTOMS IN COMMON.

Both are often associated with projection of the eyeball.
" " " " effacement of the nostril.
" " " " depression of roof of mouth.
" " " " bulging of the cheek.
" " " " closure of the lachrymal duct.
" " " " interference with mastication.
" " " " " " deglutition.
" " " " parchment-like crepitus when the bone becomes thin.

SPECIAL TYPES.

CYSTIC TUMOR OF ANTRUM.	MALIGNANT TUMOR OF ANTRUM.
Rapidity of Growth.	
The tumor grows slowly.	The tumor grows rapidly.
Age.	
The tumor occurs in the young.	The tumor occurs late in life, as a rule.
Pain.	
The tumor is painless.	Great pain is present of a peculiar lancinating character.
Palpation of Tumor.	
The tumor is smooth, hard and elastic.	The tumor has no elasticity, but may be hard, or fluctuant in spots in late stages.
Mucous Membrane of Mouth.	
The mucous membrane of the mouth is healthy.	The mucous membrane of the mouth is involved as a rule.
Hemorrhage.	
No tendency to hemorrhage exists.	Hemorrhages occur frequently and are often severe in character.

SYMPTOMS IN COMMON.

Both *may* be associated with protrusion of eyeball.
" " " " depression of roof of mouth.
" " " " effacement of nostril.
" " " " closure of lachrymal duct.
" " " " impairment of mastication.
" " " " " " deglutition.
" " " " bulging of the cheek.

SPECIAL TYPES.

EXTRA-CRANIAL TUMORS.	INTRA-CRANIAL TUMORS.
RESPIRATORY MOVEMENTS.	
The tumor shows no respiratory movements.	The tumor shows "*respiratory movements,*" rising with expiration, and falling with inspiration, from pressure on the vessels.
SIZE OF TUMOR.	
The tumor is constant in its size, save as its growth causes it to enlarge.	The tumor is frequently enlarged in size during fits of coughing or of crying.
REDUCIBILITY.	
The tumor cannot be made to disappear on direct pressure.	The tumor can be reduced within the skull, either entirely or in part, by pressure upon it.
EFFECTS OF PRESSURE.	
No cerebral symptoms of compression are produced by pressure upon the tumor.	Cerebral symptoms indicative of compression often occur on attempts at reduction of the tumor.
The tumor is constant in its size, either under pressure, or when pressure is removed.	The tumor returns after reduction when the pressure is removed.
ABNORMAL APERTURE IN BONE.	
No aperture in the cranial bones can be detected.	An aperture in the bone is often felt after the tumor has been reduced.

SYMPTOMS IN COMMON.

Both may be associated with an absence of cerebral disturbance.
" " " " similar feel and consistence.
" " " " rapid or slow formation.
" " " " absence of apparent causation, or knowledge of congenital defect.

SPECIAL TYPES.

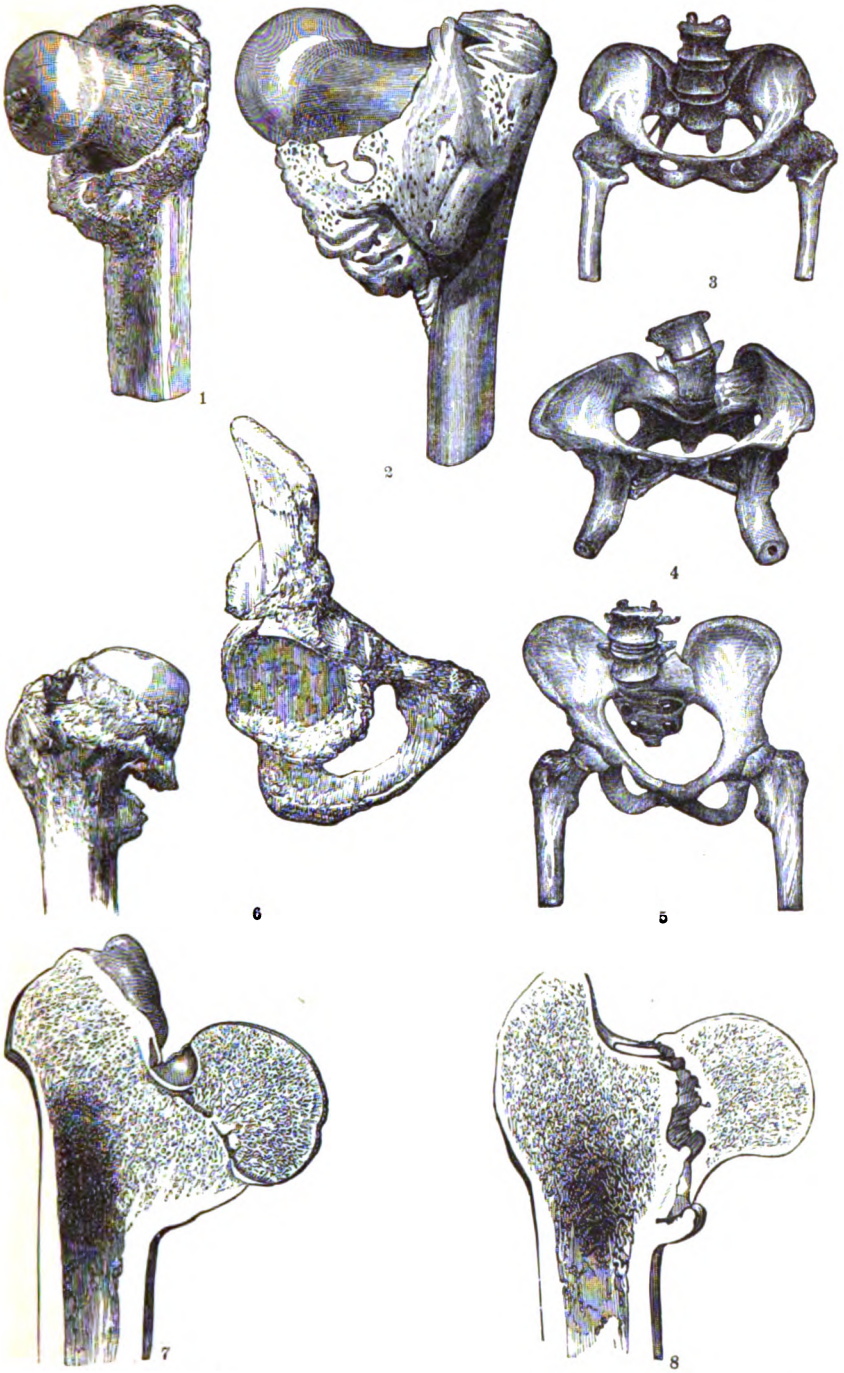
EXOSTOSES OF CRANIUM.	SEBACEOUS TUMORS.
PALPATION OF TUMOR.	
The tumor has a characteristic bony hardness.	The tumor is often tense and hard, but has *elasticity*.
MOBILITY OF TUMOR.	
The tumor is immovable under the skin.	The tumor moves freely under the integument.
CONDITION OF DUCTS.	
No abnormal condition of the ducts of the part is perceived.	An obstruction to the ducts is evidenced by a small black spot over the seat of the tumor.
EFFECTS OF PRESSURE.	
Firm pressure causes no change in the tumor.	Firm pressure often evacuates the contents of the sac, causing a foul, offensive-smelling, cheesy-like material to exude.

SYMPTOMS IN COMMON.

Both are frequently multiple.
" " of slow growth.
" " distinctly circumscribed in outline.

DISLOCATIONS.

PLATE IX.



1. Osseous growths from impacted fracture. 2. Osteophytes of femur. 3, 4, 5. Rachitic pelves. 6. Chronic rheumatic arthritis of the hip joint. 7. Fracture of neck of femur with cartilaginous union. 8. Fracture of neck of femur with osseous union.

DISLOCATIONS.

By the term *dislocation* is meant "a *solution* of the *contiguity* of *bone*."

Dislocations may be either complete or partial. To the latter type the term *subluxation* is applied.

Dislocations may result from five distinct classes of causes:

1. Direct violence.
2. Indirect violence.
3. Muscular contraction.
4. Disease of the articular surfaces of the bone.
5. Destruction of the ligaments by ulceration, suppuration, or injury.

The general symptoms of dislocation are

1. Deformity of the joint.
2. Impaired function of the joint.
3. Change in the axis of the injured limb.
4. Disturbed relation of the bony prominences of the joint from their normal bearing to each other.
5. Difficult reduction.
6. Local pain and altered sensibility of parts supplied by special nerves.

Dislocations may be classified into the following varieties:

A. *Simple Dislocations*, where the articular surfaces of a joint are displaced, but the surrounding tissues are normal.

B. *Compound Dislocations*, where the displaced articular surfaces of the joint are in communication with the external air.

C. *Complicated Dislocations*, where nerves, vessels, muscles, cavities, or organs are implicated, from injury produced by the displacement.

D. *Spontaneous Dislocations*, where the displacement of the ar-

ticular surfaces of a joint occurs from disease, without apparent external causation.

E. *Congenital Dislocations*, where the articular surfaces of a joint are not in their normal position at the time of birth.

Dislocations of special joints will be considered in this volume in the following order:

1st.	Dislocations	of the	Inferior Maxilla.
2d.	"	"	Shoulder Joint.
3d.	"	"	Clavicle.
4th.	"	"	Elbow Joint.
5th.	"	"	Wrist Joint.
6th.	"	"	Hip Joint.
7th.	"	"	Knee Joint.
8th.	"	"	Ankle Joint.

Many types of these varieties are often obscure, and are sources of frequent error in diagnosis.

Each source of doubt as to the variety of injury present will be considered as the special dislocations are reviewed, since it is impossible to group into a general classification the many points of differentiation which pertain to individual localities.

DISLOCATIONS OF THE JAW.

The dislocations of the inferior maxilla may be unilateral or bilateral.

The condyle of the jaw slips from the glenoid fossa into the zygomatic fossa, and the coronoid process of the inferior maxilla impinges upon the malar prominence.

This type of dislocations ensues either from spasmodic contraction of the depressor muscles of the chin, or from blows delivered upon the chin when the mouth is widely open.

Dislocations of the jaw are to be diagnosed from each other, and from

1. Congenital sub-luxation of one side.
2. Chronic rheumatic arthritis of the tempero-maxillary articulation.

Dislocations of the jaw are quite frequently met with in surgical practice, and having once occurred are liable to occur again.

UNILATERAL DISLOCATION OF JAW.	BILATERAL DISLOCATION OF JAW.
SEPARATION OF TEETH.	
The teeth are displaced, but are not widely separated.	The teeth are widely separated, and the mouth is open.
DISPLACEMENT OF CHIN.	
The chin is deflected towards the unaffected side.	The chin is projected forwards, but is not deflected.
APPEARANCE OF CHEEK.	
The coronoid process produces a bulging of the cheek on the affected side.	The cheeks are flattened.
HOLLOW AT EAR.	
An indistinct hollow is felt at the ear.	An *empty space* is felt in front of and below each ear.
POWER OF ARTICULATION.	
The articulation of words is only slightly embarrassed.	The articulation of labials is impossible.
MASSETER MUSCLE.	
The masseter muscle is slightly prominent on side affected.	Both masseter muscles stand out in bold relief.
TEMPORAL FOSSA.	
The temporal fossa on the affected side is nearly normal in appearance.	The temporal fossæ on both sides are filled with the displaced temporal muscles.
FACIAL EXPRESSION.	
The expression of the face is one of simple distortion.	The expression of the face is one of distress and alarm.

SYMPTOMS IN COMMON.

Both are associated with deformity and pain.
" " " " impaired mobility.
" " " " " articulation of words.
" " " " " mastication.
" " " " *salivation.*
" " " " change in expression.
" " " " projection of the under teeth.

UNILATERAL DISLOCATION OF JAW.	CONGENITAL DISLOCATION OF JAW.
MOBILITY.	
The movements of the jaw are greatly embarrassed.	Movement of the jaw is but slightly impaired,—is often normal.
TEETH.	
The teeth are separated and the chin is deflected.	The *upper teeth* project beyond the under teeth.
SALIVATION.	
Salivation is present, and is often annoyingly profuse.	Salivation is slight, and may often be absent.
APPEARANCE OF CHEEK.	
The cheek is prominent on the affected side.	The fulness of the cheek is absent, from osseous and *muscular* atrophy.
LENGTH OF FACE.	
The two sides are not markedly altered in length.	One side of the face is markedly longer than the opposite.
ALTERATION OF FEATURE.	
The features are slightly altered by the deflection of the chin, and the prominent cheek.	The features are twisted, and are not symmetrical.

SYMPTOMS IN COMMON.

Both may be associated with abnormal position of the teeth.
" " " " salivation.
" " " " alteration in feature.
" " " " absence of perfect symmetry of the two sides of the face.

DISLOCATION OF THE JAW. CHRONIC RHEUMATIC ARTHRITIS of the TEMPERO-MAXILLARY ARTICULATION.

ADVENT.

The disease is of *sudden* advent.

The disease comes on slowly.

PAIN.

The pain felt is not referred to the region of the glenoid fossa.

Constant pain *at the seat of articulation* exists; increased by dampness, or atmospheric changes.

AGE.

Dislocation occurs at any age; is frequent in adult life.

It occurs in the *old*, as a rule.

EFFECTS ON FUNCTION.

The function of the jaw is destroyed, in the bilateral variety.

The functions of the joint are embarrassed, but not destroyed.

GLENOID FOSSA.

An empty space exists in front of the ear.

The *enlarged condyles* can frequently be felt in front of, and below the ears.

GLANDULAR ENLARGEMENT.

No glandular enlargement is present.

Enlargement of the parotid, and of the glands behind the ear often exists.

SALIVATION.

Salivation is present, and is profuse.

Salivation is usually absent.

SYMPTOMS IN COMMON.

Both are associated with facial distortion.
" " " " projecting *under teeth.*
" " " " *pain.*
" " " " *impaired function.*

DISLOCATIONS AT THE SHOULDER JOINT.

The upper end of the humerus may be dislocated in five directions, as follows:

A. DOWNWARDS, called the "SUB-GLENOID" dislocation; the head of the bone lying below the glenoid cavity, and felt in the cavity of the axilla.

B. DOWNWARDS and BACKWARDS, called the "SUB-SPINOUS" dislocation; the head of the humerus lying underneath the spine of the scapula.

C. DOWNWARDS and INWARDS, called the "SUB-CORACOID" dislocation; the head of the humerus lying deep down underneath the coracoid process.

D. FORWARDS and INWARDS, called the "SUB-CLAVICULAR" dislocation; the head of the humerus lying under the clavicle.

E. UPWARDS and INWARDS, called the "SUPRA-CORACOID" dislocation; the coracoid process being fractured by the humerus, and the articular head of that bone being apparent above the clavicle. This dislocation, however, is very rare.

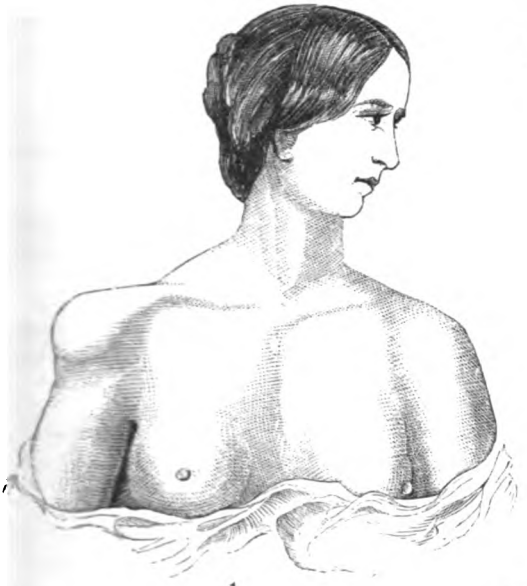
The anatomical names applied to the various dislocations of the humerus out of the glenoid cavity are based, as can be seen by the above, on the abnormal location of the *displaced* articular head of the humerus. I shall employ them in the following diagnoses as they best convey, to my mind, the condition of body, which they are intended to express.

Dislocations of the *Shoulder Joint* are to be diagnosed

1st. From each other.
2d. " separation of the greater tubercle of the humerus.
3d. " fracture of the neck of the humerus.
4th. " " " " " scapula.

A *general* and *useful test*, to decide the existence of dislocation at the shoulder, can be made by applying a straight ruler to the acromion process of the scapula, and the external condyle of the humerus. If the *ruler can touch both points simultaneously*, a dislocation is present, since the normal prominence of the deltoid muscle renders it impossible, when the shoulder joint is normal.

PLATE X.



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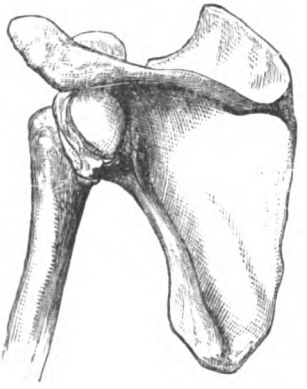

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1. Sub-glenoid dislocation of humerus. 2. Sub-coracoid dislocation of humerus. 3. Dislocation of acromial end of clavicle. 4. Dislocation of sternal end of clavicle. 5. Sub-spinous dislocation.

SUB-GLENOID DISLOCATION.	FRACTURE OF THE NECK OF HUMERUS.
ACROMION.	
The acromion process of the scapula is pointed and prominent.	The acromion process is only slightly prominent, since the upper fragment of the humerus is still in its normal position.
DEPRESSION AT SHOULDER.	
A distinctly marked depression exists *immediately* below the acromion.	An indistinct depression exists a *short distance* below the acromion process, at the seat of fracture.
TUMOR IN AXILLA.	
A large, smooth and rounded tumor is felt high up in the axilla, —(displaced head of bone).	An irregular and pointed tumor is felt low down in the axilla,— (lower fragment of humerus).
CREPITUS.	
Crepitus is usually absent.	Crepitus can be easily obtained, but is transient if the extending force be removed.
LENGTH OF ARM.	
The length of the arm is *increased.*	The length of the arm is *diminished.*
DIRECTION OF ELBOW.	
The elbow cannot be made to touch the affected side of the chest.	The elbow can easily be approximated to the side of the chest.
AXILLARY FOLD.	
The anterior fold of the axilla is often prominent.	The axillary walls are normal in appearance.
REDUCIBILITY.	
Reduction is difficult, but *permanent* when accomplished.	Reduction is easily accomplished, but is *transient* if the force be removed.

SUB-GLENOID DISLOCATION (*continued*).	FRACTURE OF THE NECK OF HUMERUS (*continued*).
HISTORY.	
A history of a fall upon the hand or elbow, when removed from the chest; or of a direct blow downwards on the upper part of the humerus exists.	A history of direct violence is usually present.
MOTION.	
Voluntary motion is lost, and communicated motion is limited in its extent.	Voluntary motion is lost, but communicated motion is very free under an anæsthetic.
RULER TEST.	
A flat board or a ruler can be made to touch the acromion process and the external condyle of the humerus *simultaneously*.	This test is impracticable in case of fracture.

SUB-CLAVICULAR DISLOCATION.	SUB-SPINOUS DISLOCATION.
HISTORY.	
Occurs in falls upon the shoulder or elbow, when the arm is directed backwards.	Occurs in falls upon the shoulder or elbow, when the arm is directed forwards.
ACROMION PROCESS.	
The acromion process and the depression underneath it are most marked posteriorly.	The acromion process and the depression underneath it are most marked anteriorly.
LENGTH OF ARM.	
The length of the arm is *shortened.*	The length of the arm is *normal,* or occasionally lengthened.
POSITION OF ELBOW.	
The elbow is directed backwards, and is separated from the chest.	The elbow is directed forwards, and separated from the chest. The forearm is usually also flexed upon the arm.
PAIN.	
The pain is severe in character, and is usually constant.	The pain is only severe when attempts at motion are made.
VOLUNTARY MOTION.	
The voluntary motion is very limited.	Voluntary motion is less limited than in any other dislocation.
COMMUNICATED MOTION.	
Communicated motion is restricted *outwards* and *forwards.*	Communicated motion is restricted *backwards* only.
HEAD OF HUMERUS.	
The displaced head is felt as a tumor rotating with the humerus, below the clavicle.	The displaced head of the humerus is felt to rotate under the spine of the scapula, near its angle.

SYMPTOMS IN COMMON.

Both are associated with deformity.
" " " " altered axis of limb.
" " " " pain.
" " " " possible crepitus.
" " " " increased circumferential measurement of the joint.
" " " " impairment of function.

"SUB-SPINOUS" DISLOCATION.	SEPARATION OF THE GREAT TUBERCLE.
TUMOR.	
The tumor felt upon the scapula is large and rounded,—(displaced head).	The tumor upon the scapula is small,—(displaced tubercle).
The tumor rotates with the humerus.	The tumor is not affected by rotation of humerus.
AGE.	
Is frequent at all periods of life.	Is frequent in youth, under 15th year.
GLENOID CAVITY.	
The glenoid cavity is empty as felt through the axilla.	The glenoid cavity is filled.
PROMINENCE OF ACROMION.	
The acromion and coracoid processes are prominent.	The acromion and coracoid processes are *not* markedly prominent.
DEPTH OF SHOULDER.	
The shoulder affected is not altered in its antero-posterior measurement.	The affected shoulder is greatly *increased in depth*, and the deltoid region is distorted in its appearance.
COMMUNICATED MOVEMENTS.	
Elbow cannot touch the side of *chest*. The hand cannot touch the top of head. The hand cannot touch the *opposite shoulder*.	The elbow can be made to touch the side of the chest, and the hand can be placed by the surgeon in almost any position.
REDUCTION.	
Reduction is accomplished by extension and motion.	Reduction is accomplished by outward rotation of the humerus and pressure over the humerus and the fragment.
TENDENCY TO RETURN.	
The reduction is *permanent* when accomplished.	The reduction is *transient* if the force be removed.

SYMPTOMS IN COMMON.

Both are associated with deformity.
" " " " pain.
" " " " impairment of function.
" " " " a history of accident.

"SUB-CORACOID" DISLOCATION.	"SUPRA-CORACOID" DISLOCATION.
ORIGIN.	
Occurs in falls upon the shoulder or elbow when the arm is directed backwards.	Occurs from the same form of accident, but with force enough to usually *fracture* the coracoid process.
SHORTENING.	
The arm is slightly shortened.	The arm is usually markedly shortened.
MOBILITY OF ARM.	
Motion of the arm is restricted *outwards* as the bone impinges upon the coracoid process.	The motion of the arm is restricted forwards and outwards.
LOCATION OF TUMOR.	
The tumor is felt underneath the coracoid process of the scapula and is obscure in its outline.	The tumor is felt upon the coraco-acromial ligament, touching externally the inner border of the acromion, and projecting under and raising the deltoid muscle, and possibly piercing it.
POSITION OF ELBOW.	
The elbow is directed backwards and is separated from the chest.	The elbow is not directed markedly backwards, but is slightly separated from the chest.
ACROMION.	
The acromion process is most prominent posteriorly and the depression under it is more noticeable behind than in front.	The acromion process may be *masked* anteriorly by the deltoid prominence over the dislocated head of the humerus.

SYMPTOMS IN COMMON.

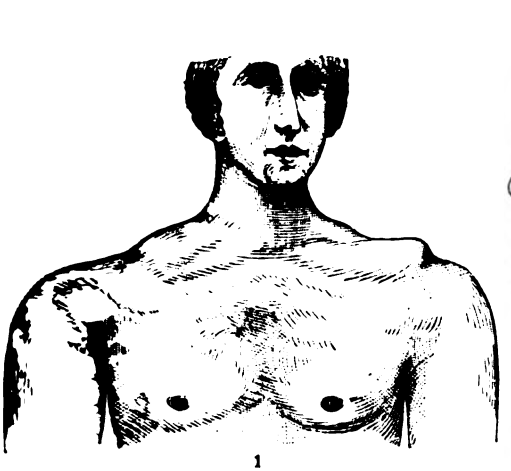
Both are associated with deformity.
" " " " impairment of function.
" " " " abnormal axis of limb.
" " " " pain.
" " " " restricted movement.
" " " " history of an accident.

"SUB-CLAVICULAR" DISLOCATION.	"SUPRA-CORACOID" DISLOCATION.
PROMINENCE OF ACROMION.	
Most marked posteriorly.	Acromion may be masked, anteriorly, by prominence of the deltoid over the dislocated head of humerus.
LENGTH OF ARM.	
Slightly shortened.	Markedly shortened.
POSITION OF THE ELBOW.	
Directed backwards.	Directed backwards, but not markedly so.
MOTION.	
Voluntary motion is very limited. Communicated motion is restricted *outward* and *forward*.	All motion is restricted in a forward and outward direction.
SITUATION OF HEAD OF HUMERUS.	
Below the clavicle.	Upon the coraco-acromial ligament, touching externally the inner border of the acromion.
HISTORY.	
Fall upon shoulder or elbow, where arm is directed backwards.	Fall upon shoulder or elbow when the arm is directed backwards, but with force enough to usually *fracture* the coracoid process.

SYMPTOMS IN COMMON.

Both are associated with shortening of the arm.
" " " " restricted motion in a forward and outward direction.

PLATE XI.



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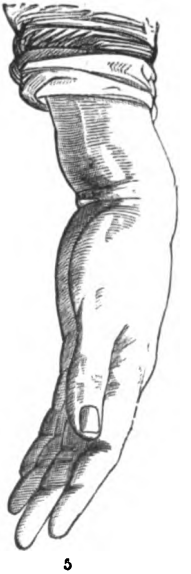

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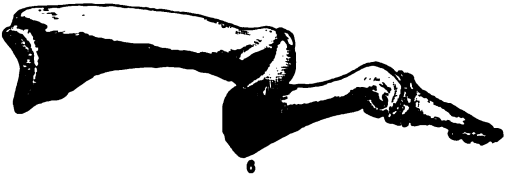

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1. Upward dislocation of outer end of clavicle. 2. Dislocation of lower jaw. 3. Normal shoulder. 4. Sub-spinous dislocation. 5. Deformity of Colles' fracture. 6. Dislocation of second phalanx.

TABLE OF DISLOCATIONS AT THE SHOULDER JOINT.

"SUB-GLENOID."	"SUB-SPINOUS."	"SUB-CORACOID."
PROMINENCE OF ACROMION.		
Most marked laterally.	Most marked anteriorly.	Most marked posteriorly.
LENGTH OF ARM.		
Increased.	Normal, or slightly increased.	Slightly shortened.
POSITION OF THE ELBOW.		
Directed outwards.	Directed forwards.	Directed backwards.
MOTION.		
Voluntary motion lost, and communicated motion limited in extent.	Voluntary motion less limited than any other dislocation. Communicated motion restricted *backwards* only.	All motion *outwards* is restricted.
SITUATION OF HEAD OF HUMERUS.		
High up in axilla.	Under spine of scapula, near its angle.	Underneath the coracoid process, and obscure in its outline.
HISTORY.		
A fall on the hand or elbow, when removed from the chest; or a direct blow downwards on the upper part of the humerus.	A fall upon the shoulder or elbow, when the arm is directed forwards.	A fall upon the shoulder or elbow, when the arm is directed backwards.

DISLOCATIONS OF THE CLAVICLE.

The dislocations possible to the clavicle are of seven varieties. Three of these are confined to the sternal end, three to the acromial end, while a rare case of simultaneous dislocation of both ends has been recorded.

The sternal end of the clavicle may be dislocated *upwards*, *forwards*, or *backwards;* the displaced head being separated from its normal sternal attachments, and the axis of the bone being no longer symmetrical with that of its fellow.

The dislocations of the acromial end of the clavicle are as follows:

1. "SUPRA-ACROMIAL,"—when the clavicle rests upon the upper surface of the acromion process.—(This variety is *most* frequent.)
2. "INFRA-ACROMIAL,"—where the clavicle is, by some violent wrench, slipped underneath the acromion process.—(Very rare.)
3. "INFRA-CORACOID,"—when the outer end of the clavicle is wedged underneath the coracoid process of the scapula.—(Very rare.)

The dislocations of the outer end of the clavicle are of far greater frequency than those of the sternal extremity, although any of the displacements of the clavicle are rare when compared with fractures of that bone.

Dislocations of the clavicle are, as a rule, easy of diagnosis. The deformity produced by the displaced extremity of the bone, the shortening of the shoulder, the impaired motion and local pain will usually render the diagnosis positive.

The dislocation of the *sternal end backwards* may perhaps lead to some confusion in diagnosis, and deserves, therefore, special mention.

This displacement has been known to result from severe direct blows, such as a kick of a horse, a violent fall upon the shoulder, being crushed between a carriage and a wall, etc., etc., and also to occur *independently* of any accident, by progressive *lateral curvature* of the spine.

Its importance, in a surgical aspect, lies in the alarming symptoms which may be produced by the pressure exerted upon the trachea, œsophagus and large blood-vessels, by the displaced head of the clavicle. Thus, in several cases, have symptoms of ap-

proaching death been relieved only by rapid reduction, and by appropriate surgical appliances for the maintenance of the bone in its normal position.

The absence, then, of the normal prominence of the sternal end of the clavicle, following a severe injury, or occurring with lateral curvature, should always lead towards a suspicion of partial or complete luxation, and especially so if symptoms indicative of impeded respiration, circulation, or deglutition accompany the deformity.

The so-called *dislocations of the scapula* are too often only partial luxations of the acromial end of the clavicle. In fact it is almost an anatomical impossibility for the scapula to be turned upon its edge, thus allowing the latissimus dorsi muscles to slip behind it, without an altered relation at the clavico-scapular articulation. In this condition, however, the scapula stands out from the back like a rudimentary wing, and causes a most marked and striking deformity.

DISLOCATIONS OF THE ELBOW JOINT.

The dislocations at the elbow joint may be divided into two great varieties:

A. Where both bones of the forearm are simultaneously displaced.

B. Where only a single bone of the forearm is displaced from its normal position.

Under the *first class*, A, may be enumerated:

1. Dislocation of both bones of the forearm *directly backwards.*

   This dislocation is the *most common* form, and is not infrequently associated with fracture of the *coronoid process* of the ulna.

2. Dislocation of both bones of the forearm *backwards* and *inwards.*
3. Dislocation of both bones of the forearm *backwards* and *outwards.*
4. Dislocation of both bones of the forearm *forwards.*

   This dislocation is *very rare,* and when present is usually associated with fracture of the olecranon process of the ulna.

5. Dislocation of the ulna *backwards* and the radius *forwards.*

This type of dislocation is infrequent.

Under the *second class*, B, may be enumerated:

1. Dislocation of the ulna *backwards.*
2. " " " *inwards.*
3. " " " *forwards.*
4. Dislocation of the radius *backwards.*
5. " " " *outwards.*
6. " " " *forwards.*

Of these last-named dislocations of single bones of the forearm, many are rare; and some, if present, are too easily recognized to cause possible error in diagnosis.

Should doubt exist in these cases, however, the impaired mobility of the joint, the deviation from the normal appearances of the bony prominences as compared with those of the uninjured member, and the alteration in length either of the forearm, or of the upper extremity, will easily confirm the diagnosis of dislocation.

I have enumerated in detail in the following pages, therefore, only those dislocations of the elbow joint which are liable to be confounded with each other, or to be mistaken for either fracture or severe contusion in the immediate neighborhood of the elbow.

BOTH BONES OF FOREARM BACKWARDS.	FRACTURE ABOVE THE CONDYLES OF THE HUMERUS.
HISTORY OF ACCIDENT.	
Occurs in falls upon the hand, or on the forearm, when the humerus is fixed.	Occurs in falls upon the elbow.
ANTERIOR TUMOR.	
A large, oval-shaped tumor (the lower end of the humerus), is felt anteriorly *below* the crease of the elbow.	A small pointed tumor (the upper fragment of humerus), is felt anteriorly, lying *above* the crease of the elbow.
POSTERIOR TUMOR.	
A tumor is perceived posteriorly which exhibits the outline of the displaced bones.	A large posterior tumor is perceived, which exhibits the outline of the two condyles and the olecranon process.
OLECRANON.	
The olecranon process is separated from the condyles of the humerus.	The relation between the olecranon process and the condyles of the humerus is normal.
MOBILITY.	
The joint is usually immovable.	Extreme mobility is present.
CREPITUS.	
Crepitus is either absent, or, if present, is of a rubbing character.	Crepitus is always present, and is of that fine grating character characteristic of fracture.
LENGTH OF HUMERUS.	
The humerus is normal in length on measurement from the acromion process to the external condyle.	The humerus is shortened, as detected by measurement from the acromion process to the external condyle.

BOTH BONES OF FOREARM BACKWARDS (*continued*).	FRACTURE ABOVE THE CONDYLES OF THE HUMERUS (*continued*).
REDUCTION.	
Reduction is difficult, but permanent when effected.	Reduction is easily produced by extension, but is transient if the force be removed.

SYMPTOMS IN COMMON.

Both are associated with shortening of the entire limb.
" " " " a tumor in front of normal situation of joint.
" " " " a tumor behind the " " "
" " " " pain.
" " " " history of an accident.
" " " " alteration in the normal mobility.
" " " " impaired function.

BOTH BONES OF FOREARM BACKWARDS.	RADIUS FORWARDS AND ULNA BACKWARDS.
MOTION OF THE JOINT.	
Extension and flexion of the joint *may* be retained to a slight degree.	All motion is lost in the affected joint.
POSITION OF THE FOREARM.	
The forearm is not twisted from its normal attitude.	The forearm and hand are slightly flexed and twisted inwards.
DIAMETERS OF THE JOINT.	
The transverse diameter of the joint is normal, and the antero-posterior diameter only slightly increased.	The antero-posterior diameter of the joint is markedly increased, and the transverse diameter diminished.
CONDITION OF TENDONS.	
The biceps tendon is *tense.*	The biceps and triceps tendons are both *relaxed.*
ANTERIOR TUMOR.	
The anterior tumor which exists is large, and *below* the crease of the elbow.	The anterior tumor is small, and is *above* the crease of the elbow.
POSTERIOR TUMOR.	
The posterior tumor exhibits the contour of the two displaced bones.	The posterior tumor exhibits the contour of the projecting olecranon.
HISTORY OF ACCIDENT.	
A history of a fall upon the hand, or upon the forearm when the humerus was fixed, is present.	A history of a fall upon the hand, associated with twisting of the forearm exists.

SYMPTOMS IN COMMON.

Both are associated with altered relations between the bony prominences of the joint.

" " " " greatly impaired motion.
" " " " an anterior and posterior tumor.
" " " " alteration in the *diameters* of the joint.
" " " " pain.
" " " " shortening of the entire limb.
" " " " normal length of the humerus.

BOTH BONES OF FOREARM FORWARDS.	BOTH BONES OF FOREARM BACKWARDS.
FREQUENCY.	
Is of very rare occurrence, and is usually associated with fracture of the olecranon process of the ulna.	Is a frequent dislocation, and may be associated with a fracture of the coronoid process of the ulna.
CONDYLES OF HUMERUS.	
The condyles of the humerus are prominent *posteriorly.*	The condyles of the humerus are prominent *anteriorly.*
TENSION OF PARTS.	
The parts anterior to the joint are very tense.	The biceps tendon is tense, but the integument is normal.
PROJECTION OF THE OLECRANON.	
The projection of the olecranon process is absent.	The projection of the olecranon process is present, posteriorly.
MOBILITY OF FOREARM.	
The forearm can be extended straight, and even more than straight; so as to render the coronoid process and the head of the radius prominent.	The forearm may possibly admit of *slight* flexion and extension, and may, in some cases, be immovable.
LENGTH OF FOREARM.	
The forearm is usually lengthened.	The forearm is shortened.
POSITION OF FOREARM.	
The forearm is slightly flexed, or it may be extended.	The forearm is extended, as a rule.
CIRCUMFERENCE OF JOINT.	
The circumference of the joint is diminished.	The circumference of the joint is usually markedly increased.
CREPITUS.	
Crepitus exists, if fracture be present.	Crepitus may exist, if the coronoid be fractured.

BOTH BONES OF FOREARM FORWARDS (*continued*).	BOTH BONES OF FOREARM BACKWARDS (*continued*).
PAIN AND SWELLING.	
The pain and swelling are very severe.	The pain and swelling are moderate in severity.

SYMPTOMS IN COMMON.

Both are associated with prominence of the condyles of the humerus.
" " " " localized tension of soft parts.
" " " " alteration in the length of forearm.
" " " " altered circumference of the joint.
" " " " possible crepitus.
" " " " local pain and swelling.

BOTH BONES OF FOREARM BACKWARDS.	ULNA ALONE, BACKWARDS.
APPEARANCE OF ELBOW.	
An anterior tumor exists *below* the crease of the elbow.	An anterior depression exists over the seat of the ulnar articulation.
HEAD OF RADIUS.	
The head of the radius is displaced.	The head of the radius is normal.
EFFECTS ON MOTION.	
Pronation and supination are lost.	Pronation and supination are normal.
Flexion and extension of the joint are lost, or very limited.	Flexion and extension of the joint are difficult and very painful.
LENGTH OF FOREARM.	
Both sides of the forearm are equally shortened.	The ulnar side of the forearm is shortened.
AXIS OF FOREARM.	
The forearm is usually in the direct line of the arm.	The forearm and hand are slightly flexed.
POSITION OF THE HAND.	
The hand is supinated.	The hand is turned inwards.
SWELLING.	
The swelling is marked, and occurs early after the accident.	The swelling is slight, as a rule.
CIRCUMFERENCE OF THE JOINT.	
The circumference of the joint is often greatly increased.	The circumference of the joint is nearly normal.

SYMPTOMS IN COMMON.

Both are associated with an abnormal projection of the olecranon.
" " " " relaxation of the triceps muscle.
" " " " impaired function of the joint.
" " " " pain and swelling at the joint.
" " " " a history of an accident.
" " " " shortening in the forearm.
" " " " alteration in measurements of the joint.

RADIUS BACKWARDS.	RADIUS FORWARDS.
FREQUENCY.	
Is a rare deformity.	Is the most common displacement of the radius.
POSITION OF THE HAND.	
The hand is pronated, and the arm turned outwards.	The hand is twisted inwards, as a rule.
LOCATION OF TUMOR.	
A tumor is felt *behind* the elbow, which rotates on motion of the radius.	A tumor is felt *in front of* the elbow, which rotates with a similar motion in the radius.
ABNORMAL DEPRESSION.	
A depression exists anteriorly over the normal seat of the head of the radius.	A depression exists posteriorly, which is most marked at the external condyle.
MOTION OF HAND.	
Supination of the hand is lost; and flexion of the forearm is difficult, or absent.	Pronation of the hand is free, but supination is very painful.
BICEPS TENDON.	
The biceps tendon is very tense.	The biceps tendon is relaxed.
HISTORY OF ACCIDENT.	
A history of a fall upon the hand when pronated and extended, exists.	A history of a fall upon the hand when supinated and extended, is present.

SYMPTOMS IN COMMON.

Both are associated with free but painful extension of forearm.
" " " " inability to permit of flexion to a right angle.
" " " " an abnormal tumor.
" " " " " " depression.
" " " " impaired motion of hand and pronation.
" " " " pain at elbow joint.

ULNA BACKWARDS.	ULNA FORWARDS.
DEFORMITY.	
An anterior depression exists over the seat of the normal articulation of the ulna.	A posterior depression and an anterior tumor are produced.
MOVEMENT OF HAND.	
Pronation and supination are normal.	Pronation and supination are liable to be somewhat impaired.
MOTIONS OF FOREARM.	
Extension and flexion of the forearm are difficult and painful.	Extension and flexion are painful, but not markedly restricted, as the olecranon is usually broken.
POSITION OF FOREARM.	
Forearm and hand often slightly flexed.	The forearm is usually markedly flexed.
SWELLING.	
Swelling slight, as a rule.	The swelling about the joint is severe.
OLECRANON.	
Olecranon process felt displaced backwards.	The olecranon is usually *fractured;* it may be normal in position, or loose and freely movable.
CREPITUS.	
No crepitus is discovered.	Crepitation is often present, as the ulna is usually fractured.

SYMPTOMS IN COMMON.

Both are associated with shortening of the ulnar side of forearm.
" " " " normal position of radius.
" " " " impaired function of joint.
" " " " local pain and swelling.
" " " " history of an accident.

TABLE OF DISLOCATIONS OF THE ELBOW JOINT.

BOTH BONES OF FOREARM FORWARDS.	BOTH BONES OF FOREARM BACKWARDS.	RADIUS FORWARDS AND ULNA BACKWARDS.
	POSITION OF FOREARM.	
Slightly flexed, or may be extended.	Extended, as a rule.	Slightly flexed and twisted inwards.
	MOTION IN JOINT.	
Forearm can be extended straight, and more than straight.	Immobility, or *slight* flexion and extension.	All motion lost.
	TENSION OF TENDONS.	
Parts anterior to joint are very tense.	Biceps tendon is tense, but the integument is normal.	Biceps and triceps tendons are both relaxed.
	LENGTH OF FOREARM.	
Increased.	Diminished.	Diminished.
	PROJECTION OF OLECRANON.	
Absent.	Prominent.	Prominent.
	CONDYLES OF HUMERUS.	
Prominent posteriorly.	Prominent anteriorly.	Not prominent.
	CIRCUMFERENCE OF JOINT.	
Diminished.	Increased.	Increased.
	HISTORY OF ACCIDENT.	
Fall upon hand, or upon forearm, when humerus was rendered immovable.	Fall upon hand, or upon forearm, when humerus was rendered immovable.	Fall upon hand, associated with twisting of the forearm.

DISLOCATIONS AT THE WRIST.

Dislocations of the hand from the lower end of the radius, though described by all surgical authors, from the time of Hippocrates to the commencement of the present century, as of frequent occurrence, is now known to be an extremely rare form of injury.

Pouteau first pointed out that fracture of the inferior extremities of the bones of the forearm is liable to be mistaken for it, and his observations were subsequently confirmed by Dupuytren.

In those cases, where actual dislocation does occur, the presence of fracture of some part of the lower end of the radius may be usually detected as a complication; or the dislocation, if fracture be not present, is extremely liable to be of the compound variety.

This form of dislocation, is most frequently in the forward or backward direction, and, as a rule, is the direct result of a fall upon the hand.

A. The *carpus* may, however, be dislocated in four directions from the radius, as follows:

1. Dislocations of the carpus FORWARDS.
2. " " " BACKWARDS.
3. " " " INWARDS.
4. " " " OUTWARDS.

Dislocations of the carpal bones from the radius are to be diagnosed from

1st. SPRAIN of the wrist joint.
2d. COLLES'S FRACTURE.
3d. TRANSVERSE FRACTURE of both bones of the forearm close to the joint.
4th. SEPARATION OF THE EPIPHYSES of the ulna and of the radius.

B. All the *separate bones of the carpus* may, in rare cases, be individually displaced; but the "os magnum," only, is commonly dislocated.

The other carpal bones are so seldom altered in position as to be safely excluded from probable sources of error in diagnosis.

The points of diagnosis between dislocation of the os magnum and "ganglion of the wrist," will be found contrasted in subsequent pages of this volume.

C. The *lower end of the ulna* may be displaced upon the radius and carpus.

This displacement may be either *forwards* or *backwards.*

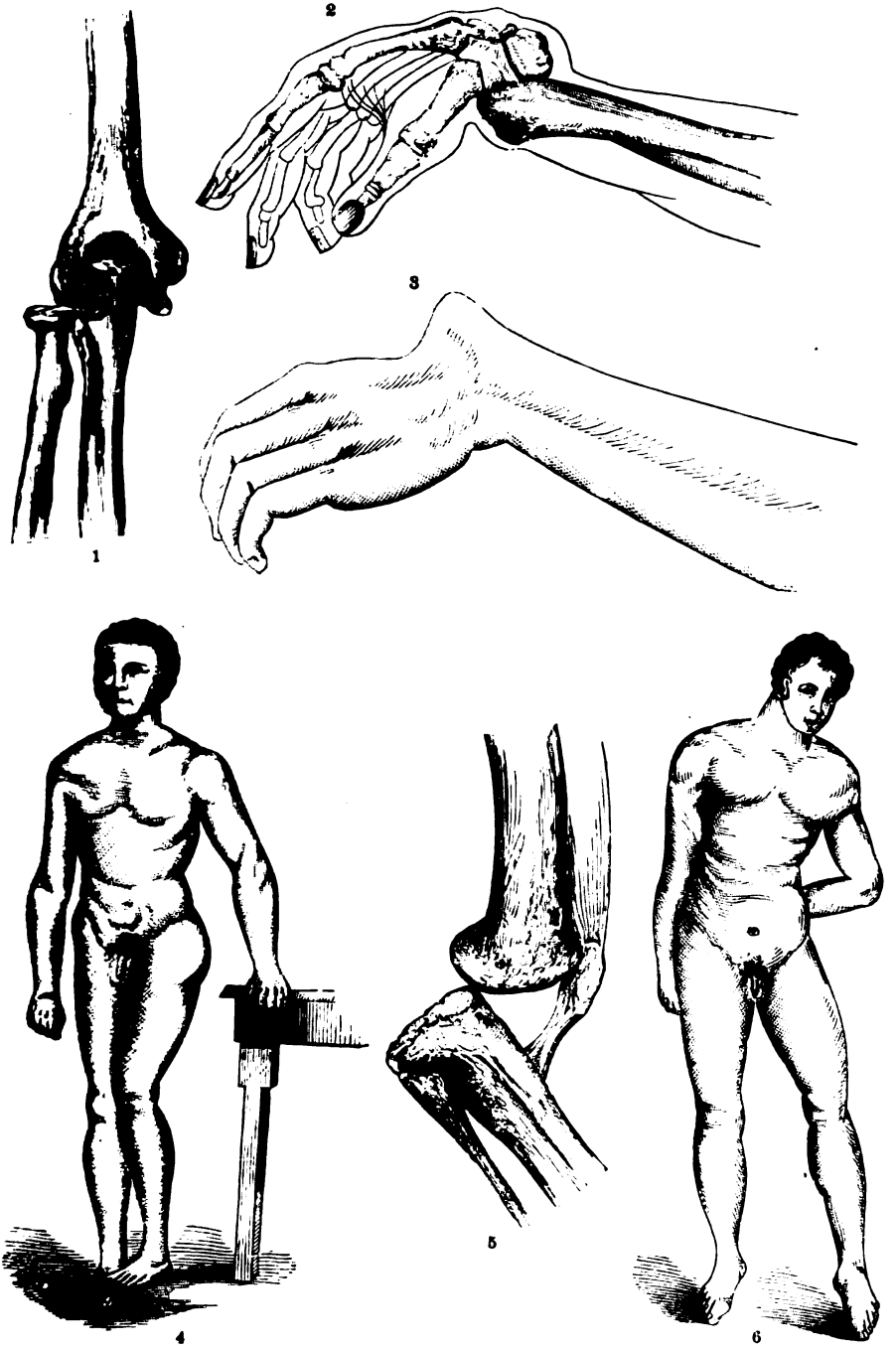
It is not infrequently associated with fracture of the radius, and usually follows violent attempts at pronation or supination of the hand.

DISLOCATION OF THE CARPUS.	COLLES' FRACTURE.
DEFORMITY.	
The deformity is bilateral, and has none of the peculiar "silver fork" displacement.	The deformity is confined to the radial side of the wrist, and has been likened to the "silver fork" in common use, the finger being analogous to the tines.
CREPITUS.	
No crepitus is present.	Crepitus is present, unless the impaction is firm.
ABNORMAL TUMOR.	
An abnormal tumor is present on *one* surface only of the forearm.	An abnormal tumor exists on *each* surface of the forearm.
This tumor is *smooth* and *round*.	These tumors are *sharp* and *pointed*.
LENGTH OF RADIUS.	
The radius is normal in length.	The radius is shortened.
LENGTH OF UPPER EXTREMITY.	
The limb is shortened.	The limb is normal in length on the ulnar side.
STYLOID PROCESS OF ULNA.	
The styloid process of the ulna is *higher* than that of the radius.	The styloid process of the ulna is *lower* than that of the radius.
The styloid process of the ulna is not markedly prominent.	The styloid process of the ulna is *markedly* prominent.

SYMPTOMS IN COMMON.

Both are associated with a history of a fall upon the hand.
" " " " deformity near the wrist.
" " " " local pain and swelling.
" " " " abnormal appearance of the styloid process of the ulna.
" " " " loss of function.

PLATE XII.



1. Lateral dislocation at elbow. 2. Dislocotion of carpus backward. 3. Dislocation of carpus forward. 4. "Sciatic notch" dislocation of femur. 5. Dislocation of tibia backward. 6. "Obturator" dislocation of femur.

DISLOCATION OF THE CARPUS.	SPRAIN OF THE WRIST JOINT.
DEFORMITY.	
The deformity is of a marked character, and is due to *bone* as detected by the touch.	The deformity is often slight, but if severe is due to swelling; no abnormal bony tumor being present.
SHORTENING.	
The forearm, including the hand, is found to be shortened, by measurement from the inner condyle of the elbow to the tips of the fingers.	No shortening can be detected by measurement.
MOBILITY OF JOINT.	
The joint is less movable than normal, even under an anæsthetic.	The joint shows normal mobility under anæsthetics.
DEVELOPMENT OF SYMPTOMS.	
The symptoms appear immediately after the accident.	An interval of time often elapses between the accident and the development of symptoms.
DURATION OF SYMPTOMS.	
The symptoms are permanent, when once developed, until reduction is effected.	The symptoms are often relieved by simple local applications.

SYMPTOMS IN COMMON.

Both are frequently associated with great pain.
" " " " " " swelling.
" " " " " deformity about the joint.
" " " " " history of an accident.
" " " " " impaired motion.

DISLOCATION OF THE CARPUS.	TRANSVERSE FRACTURE OF BOTH BONES CLOSE TO THE WRIST.
SEAT OF DISPLACEMENT.	
The seat of displacement can be located below the radius.	The seat of displacement is above the styloid process of the radius.
TUMOR.	
The bony projection is smooth and broad.	The bony projections are rough, irregular in shape, and often pointed.
LENGTH OF INFERIOR TUMOR.	
The inferior tumor attached to the hand is *short*, consisting only of the carpus.	The inferior tumor attached to the hand is *long*, consisting of the carpus and lower fragments of the bones of the forearm.
CONDITION OF TENDONS.	
The tendons on one surface of the forearm are *tense*.	The tendons of the forearm are relaxed on both surfaces.
STYLOID PROCESSES.	
The styloid processes of the radius and ulna are prominent, and abnormal in their bony relations.	The styloid processes of the radius and ulna are not prominent, and are normal in their relations.
LENGTH OF RADIUS AND ULNA.	
The radius and ulna are normal in length.	The radius and ulna are both shortened.
MOBILITY.	
The joint is partially fixed.	Great mobility exists at the seat of fracture.
CREPITUS.	
Crepitus is absent as a rule.	Crepitus is well marked.
REDUCTION.	
Reduction is permanent.	Reduction is transient, when the extending force is removed.

SYMPTOMS IN COMMON.

Both are associated with shortening of the upper extremity.
" " " " local pain.
" " " " " swelling.
" " " " " deformity.
" " " " impaired function.

DISLOCATION OF THE CARPUS.	SEPARATION OF THE EPIPHYSES OF RADIUS AND ULNA.
AGE AFFECTED.	
Occurs at any age.	Occurs in the *young*.
BONY TUMOR.	
The bony projection is regular in contour, the separate individual bones being indistinguishable.	The bony projections are often distinct, and can be felt as two smooth tumors.
SEAT OF DISPLACEMENT.	
The seat of displacement is below the radius.	The displacement occurs above the styloid process of the radius.
TENDONS.	
The tendons are tense on one surface of the forearm.	The tendons are relaxed on both surfaces of the forearm.
LENGTH OF RADIUS AND ULNA.	
The radius and ulna are of normal length.	The bones of the forearm are found shortened on measurement.
STYLOID PROCESSES.	
The styloid processes of the radius and ulna are prominent.	The styloid processes of the bones of the forearm are normal in their relation to the carpus.

SYMPTOMS IN COMMON.

Both are associated with the *absence of crepitus.*
" " " " shortening of the upper extremity.
" " " " *smoothness* of the tumor.
" " " " impaired function.
" " " " history of an accident.
" " " " local pain and swelling.
" " " " easy reducibility.

LOWER END OF ULNA BACKWARDS.	LOWER END OF ULNA FORWARDS.
History of Accident.	
Occurs during forced pronation of the hand.	Occurs during forced supination of the hand.
Location of Styloid Process of Ulna.	
The outline of the lower end of the ulna is felt behind the joint lying slightly across the radius.	The outline of the lower end of the ulna can be detected as an abnormal tumor in front of the joint.
Motion of Hand.	
Supination of the hand is impossible.	Pronation of the hand is impossible.
Position of Hand.	
The hand is markedly *pronated.*	The hand is in a position of forced *supination.*

SYMPTOMS IN COMMON.

Both are associated with a diminished transverse diameter of the joint.
" " " " an increase in the antero-posterior diameter of the joint.
" " " " an internal displacement of the hand.
" " " " normal regularity in the line of the ulna.
" " " " limited and painful flexion and extension of the hand.
" " " " shortening from inner condyle of the elbow to the tip of the little finger.
" " " " normal length from inner condyle to styloid process of ulna.
" " " " flexion of forearm, hand and fingers.
" " " " altered axis between styloid process of ulna and metacarpal bone of little finger.
" " " " absence of crepitation.
" " " " increased circumference of joint.
" " " " local pain, swelling and ecchymosis.

DISLOCATION OF THE "OS MAGNUM."	GANGLION AT WRIST.
HISTORY OF CAUSATION.	
Is usually produced by a fall upon the hand when in a state of flexion.	Is usually the result of excessive use of the tendons, as in piano playing, etc., etc.
SITUATION OF TUMOR.	
The tumor is situated in a line with the metacarpal bone of the middle finger, and always on the back of the wrist.	The tumor is not confined to any definite locality, and may be on either surface of the wrist.
VARIATION IN SIZE OF THE TUMOR.	
The size of the tumor is often augmented by flexion of the hand.	The size of the tumor is not actually increased by flexion of the hand.
The size of the tumor is often diminished by extension of the hand.	No diminution in the actual size of the tumor follows extension of the hand.
PALPATION OF TUMOR.	
The tumor is hard and bony on palpation.	The tumor is highly elastic to the touch.
REDUCIBILITY.	
The tumor is reducible by direct pressure.	The tumor is not reducible, save by rupture of its sac.

SYPMTOMS IN COMMON.

Both are associated with a tumor at wrist.
" " " " freedom of motion.
" " " " little pain or discomfort.

DISLOCATIONS AT THE HIP JOINT.

The head of the femur may be dislocated from the cavity of the acetabulum in four directions, as follows:

A. BACKWARDS, called the "SCIATIC NOTCH" dislocation; the head of the femur lying within the great sciatic notch.

B. BACKWARDS AND UPWARDS, called the "DORSUM ILII" dislocation; the head of the femur lying upon the dorsum of the ilium.

C. DOWNWARDS AND INWARDS, called the "THYROID," or "OBTURATOR" dislocation; the head of the femur lying within the obturator, or thyroid foramen.

D. UPWARDS AND INWARDS, called the "PUBIC" dislocation; the head of the femur lying upon the ramus of the pubes, underneath the psoas and iliacus muscles.

Dislocations of the femur are to be diagnosed

1. From each other.
2. " fracture of the femur with inversion of the foot.
3. " intra-capsular fracture of the femur.
4. " severe contusion over the trochanter.

In the following pages I shall employ, in speaking of the various dislocations of the femur at the hip joint, those anatomical names given to each from the location of the head of the femur in its displaced position, and mentioned above.

Nélaton's guide, to detect any displacement of the femur at the hip joint, consists of a line drawn from the anterior superior spine of the ilium to the most prominent part of the tuberosity of the ischium. This line, in the normal condition of the joint, should cross the upper border of the trochanter of the femur, and it also crosses the centre of the cavity of the acetabulum. To properly apply this test, however, the thigh should be semi-flexed and slightly adducted.

"DORSUM ILII."	"SCIATIC NOTCH."
Position of the Limb.	
The large toe of the affected side rests upon the opposite *instep.*	The large toe of the affected side rests upon the opposite *large toe.*
Position of Tumor.	
An abnormal tumor is felt plainly on the posterior portion of the ilium.	An abnormal tumor is very indistinctly perceived posteriorly, and in fat subjects it is often not detected.
Shortening.	
Shortening of the limb is *marked.*	Shortening of the limb is *slight.*
Inversion of the Foot.	
The foot is markedly inverted.	The inversion of the foot is of moderate extent.
Deformity at the Hip.	
The deformity at the hip is very apparent.	The deformity of the hip is slight, and often scarcely perceptible.
Flexion of the Thigh.	
The flexion of the thigh upon the pelvis is slightly marked.	The thigh is markedly flexed upon the pelvis, and attempts at extension of the thigh produce an arching of the back.

SYMPTOMS IN COMMON.

Both are associated with displacement upwards of the fold of the nates.
" " " " shortening of the limb.
" " " " inversion of the foot.
" " " " displacement of the trochanter.
" " " " impaired voluntary motion.
" " " " impossibility of abduction of the limb.
" " " " " " outward rotation of the limb.
" " " " flexion of the thigh upon the pelvis.
" " " " " " leg " " thigh.

"SCIATIC NOTCH."	FRACTURE OF THE FEMUR, WITH INVERSION OF THE FOOT.
MOBILITY OF LIMB.	
The affected limb is impaired as to its mobility.	The mobility of the injured limb is often increased.
REDUCIBILITY.	
Reduction of the deformity is difficult, but permanent when effected.	Reduction of the deformity is easy by simple extension of the limb, but is transient if the force be not maintained.
CREPITATION.	
No crepitus is present.	Crepitus is present, unless extreme impaction exists.
SHORTENING.	
Slight shortening of the limb is present.	The shortening is well marked.
ABNORMAL TUMOR.	
An abnormal tumor exists which is felt to rotate on motion of the femur.	The upper fragment often fails to participate in the movements of the femur.
HISTORY.	
Is most frequent in middle life, and is associated with direct violence.	If *intra-capsular* in variety, it may occur in the old, and from slight and indirect violence.
INVERSION OF FOOT.	
Inversion of the foot is permanent until reduction of the dislocation is accomplished.	The foot may become everted after extension of the limb, if the inversion be due to impaction of the fragments.

SYMPTOMS IN COMMON.

Both are associated with inversion of the foot.
" " " " shortening of the limb.
" " " " an abnormal tumor.
" " " " a history of an accident, (as a rule).
" " " " impaired function.
" " " " a normal position of the trunk.

"PUBIC" DISLOCATION.	"THYROID" DISLOCATION.
HISTORY OF THE ACCIDENT.	
Occurs from direct violence to the back of the thigh during abduction of the femur; or from the body being thrown backwards, while the thigh is fixed.	Occurs in falls associated with violent abduction and inward rotation of the femur; as in falls where the limbs are separated, especially when a burden is upon the back.
FOLD OF NATES.	
The fold of the nates is *raised.*	The fold of the nates is *lowered.*
LOCATION OF HEAD OF FEMUR.	
The head of the femur is felt under the psoas and iliacus muscles.	The head of the femur is felt below the groin, and almost in the perineum.
POSITION OF TROCHANTER.	
The trochanter of the femur is carried forwards, and is almost in a vertical line with the anterior superior spine of the ilium.	The trochanter of the femur is carried backwards.
LENGTH OF LIMB.	
The affected limb is frequently shortened.	The affected limb is lengthened.
POSITION OF FOOT.	
The foot is everted.	The foot points straight forwards.

SYMPTOMS IN COMMON.

Both are associated with *pain* which is very severe.
" " " " tension of the psoas and iliacus.
" " " " limited voluntary motion.
" " " " loss of the power of adduction.
" " " " " " " " rotation outwards.
" " " " the axis of the femur pointing downwards and outwards.
" " " " the history of an accident.

"PUBIC" DISLOCATION.	FRACTURE OF THE NECK OF THE FEMUR.
TROCHANTER.	
The trochanter of the femur is carried forwards.	The trochanter is never displaced towards the median line in front.
The trochanter is less prominent than normal.	The trochanter is normal in its prominence.
HEAD OF FEMUR.	
The head of the femur is felt in a displaced position.	The head of the bone is felt to be normal in its situation.
CREPITATION.	
No crepitus is perceived.	Crepitation is distinctly obtained.
REDUCIBILITY.	
The reduction is difficult, but permanent when effected.	The reduction is easy under simple extension, but is transient if the force be not maintained.
MOBILITY OF LIMB.	
The mobility of the affected limb is impaired.	The mobility of the injured limb is increased.

SYMPTOMS IN COMMON.

Both are associated with *eversion* of the foot.
" " " " impaired voluntary motion.
" " " " shortening of the limb.
" " " " a history of an accident.
" " " " severe local pain.
" " " " swelling and possible ecchymosis.

DISLOCATION AT THE HIP JOINT.	CONTUSION OVER THE TROCHANTER.
LENGTH OF THE LIMB.	
The limb is always altered as to its length, by actual measurement.	The limb is *apparently* shortened, due to relaxed ligaments and muscles, and pelvic inclination to relieve the pain.
MOTIONS OF JOINT.	
The motions of the injured femur are restricted, even under anæsthetics.	Free and normal movement can be established under anæsthetics.
TROCHANTER.	
The trochanter is altered from its normal relation.	The trochanter is normal in its position.
HEAD OF FEMUR.	
The head of the femur is felt to be displaced.	The head of the femur is normal in its position.
EFFECTS OF REST.	
The symptoms due to the *displacement only* are constant until relieved by reduction.	The symptoms disappear with rest and local applications.

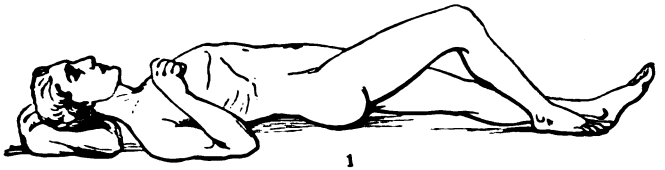
SYMPTOMS IN COMMON.

Both may be associated with severe local pain.
" " " " extensive ecchymosis.
" " " " loss of function and voluntary motion in joint.
" " " " apparent shortening of limb.
" " " " the history of an accident.
" " " " *eversion* of the foot.

TABLE OF DISLOCATIONS AT THE HIP JOINT.

"SCIATIC."	"DORSUM ILII."	"THYROID."	"PUBIC."
LENGTH OF LIMB.			
Slight shortening.	Marked shortening.	Lengthening.	Slight shortening.
POSITION OF THE FOOT.			
Toe on opposite toe.	Toe on opposite instep.	Foot straight.	Foot everted.
POSITION OF THE LIMB.			
Slight flexion of the thigh and leg. The femur points inwards.	Slight flexion of the thigh and leg. The femur points inwards.	Leg extended, abducted and brought forwards. The femur points downwards and outwards.	Limb is abducted and extended, or slightly flexed. The femur points downwards and slightly outwards.
POSITION OF THE TRUNK.			
Little affected.	Little affected.	Bent forwards. Psoas and iliacus tense.	Bent forwards. The psoas and iliacus are tense.
LOCATION OF HEAD OF FEMUR.			
Behind acetabulum.	Behind and above acetabulum.	Below the groin.	At upper part of the groin.
FOLD OF THE NATES.			
Raised.	Raised and carried backwards.	Lower than normal.	*Raised.*
EFFECTS UPON MOTION.			
Adduction and rotation easy. Abduction and outward rotation impossible.	Adduction and int. rotation easy. Abduction and ext. rotation impossible.	Abduction and flexion easy. Adduction, extension and int. rotation impossible.	Abduction and rotation out. easy. Adduction and rotation inwards impossible.
APPEARANCE OF HIP.			
Hip is prominent.	Prominent and raised.	Flattened and sunken.	Flattened.
POSITION OF TROCHANTER.			
Looks forwards.	Looks forwards.	Is inclined backwards.	Is carried forwards and inwards.
Is less prominent.	Is less prominent.	Is less prominent.	Is nearer the median line.
Is approximated to ant. spine of ilium.	Is approximated to the ant. spine of ilium.	Is removed from ant. spine of ilium.	Is less prominent.

PLATE XIII.



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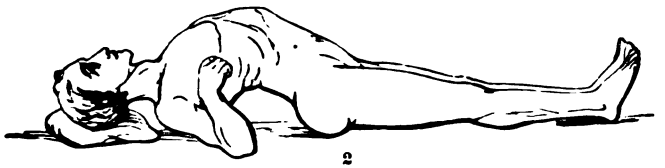

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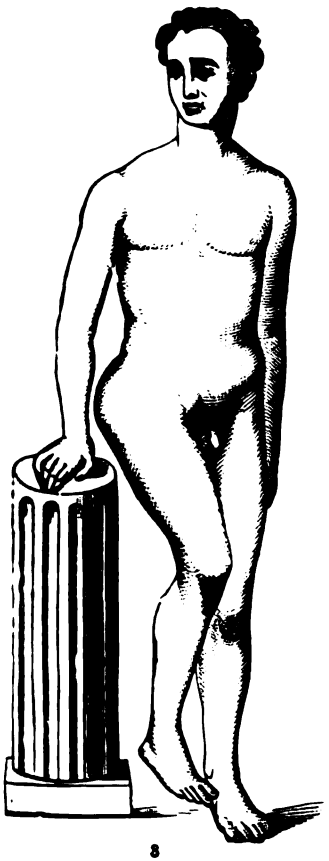

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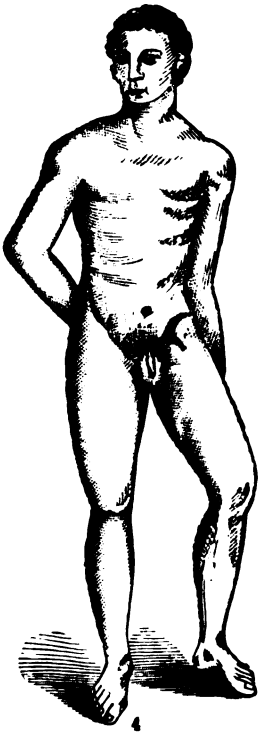

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1. Attitude of hip-joint disease. 2. Same with leg straightened. 3. "Dorsum ilii" dislocation of femur. 4. "Pubic" dislocation of femur. 5. "Sciatic notch" dislocation of femur in recumbent posture.

DISLOCATIONS AT THE KNEE.

Two bones may be dislocated at the knee joint, viz.: the TIBIA and the PATELLA.

The dislocations of the tibia from its normal relation to the lower end of the femur may be of five varieties:

A. Dislocation of the TIBIA FORWARDS, the lower end of the femur impinging upon the popliteal space, and its nerves and vessels.

B. Dislocation of the TIBIA BACKWARDS, the popliteal space being made tense by the backward projection of the *tibia*.

C. Dislocation of the TIBIA OUTWARDS.

D. Dislocation of the TIBIA INWARDS.

E. Dislocation of the TIBIA from ROTATION of that bone, which is *very rare*, but of which several cases have been reported.

Of these five dislocations the *forwards* and *backwards* dislocations are those most commonly met with in surgical practice.

The dislocations to which the patella is subject may be of four varieties:

A. Dislocation of the PATELLA OUTWARDS, the bone lying to the outer side of the knee joint.

B. Dislocation of the PATELLA INWARDS, the bone lying to the inside of the knee joint.

C. Dislocation of the PATELLA UPWARDS, the inferior ligament of the patella being ruptured and the bone displaced by the contraction of the quadriceps extensor muscle of the thigh.

D. Dislocation of the PATELLA between the FEMUR and the TIBIA,—called the "ROTARY DISPLACEMENT." In this case the patella is twisted upon itself, turned upon its edge, and impacted between the two bones forming the articulation at the knee joint.

Of the dislocations to which the patella is subject the *lateral* displacements are, by far, the most common; and of the two lateral displacements the OUTWARD variety is the one most frequently encountered.

Dislocations of the *patella* are more frequently produced by muscular action than displacements of any other bone, save the inferior maxilla.

They may be complete, or only partial in extent, and can never be produced without more or less extensive laceration of the capsule of the joint as an existing complication.

(Experiments of Professor Streubel.)

The various dislocations at the knee joint admit of little opportunity for error, save in accurately determining the variety and amount of luxation. The *upward dislocation* of the *patella* might possibly be confounded with a transverse fracture of that bone, when the seat of fracture was low down, near its inferior border, or when the dislocation is masked by swelling, thus rendering palpation negative in its results. In this latter case, however, the disappearance of the swelling would reveal the smooth contour of the dislocated bone high up above the knee, while in the former case the small remnant of bone attached to the inferior ligament of the patella might at first be overlooked, but subsequently would be discovered by a careful examination of the joint.

TIBIA BACKWARDS.	TIBIA FORWARDS.
APPEARANCE OF JOINT.	
The condyles of the *femur* are felt in front of the joint.	The condyles of the *tibia* project in front.
PATELLA.	
The anterior surface of the patella looks downwards and backwards.	The anterior surface of the patella looks upwards and forwards.
POPLITEAL SPACE.	
The tibia encroaches upon the popliteal space, which is separated from the femur.	The femur is driven into the popliteal space as a wedge, if the dislocation be complete.
LIGAMENT OF PATELLA.	
The ligament of the patella is not prominent.	The inferior ligament of the patella is prominent and tense.
AXIS OF LIMB.	
The axis of the limb is markedly irregular.	The axis of the limb is not greatly altered.
LENGTH OF LIMB.	
The length of the limb is normal.	The length of the limb is *diminished.*
VOLUNTARY MOTION.	
Voluntary motion is destroyed.	Voluntary motion may exist to a slight degree.
COMMUNICATED MOTION.	
Communicated motion is very limited and very painful.	Communicated motion is possible in the antero-posterior direction, but it is very painful.

SYMPTOMS IN COMMON.

Both are associated with pain.
" " " " local numbness and œdema.
" " " " ecchymosis.
" " " " increased circumference of the joint.
" " " " absence of crepitation.
" " " " displacement of the patella.
" " " " impaired function.
" " " " " motion.

TIBIA IN ROTARY DISLOCATION.	LATERAL DISLOCATION OF TIBIA.
FREQUENCY.	
A very rare type of dislocation.	Not a rare dislocation.
DEFORMITY.	
The *inner* condyle is generally separated from the femur by rotation, the outer condyle being normal; or both condyles may be simultaneously rotated from their normal relations.	The condyles of the tibia project laterally, with a corresponding depression upon the side opposite.
POSITION OF FOOT.	
The foot is either everted or inverted, and the tubercle of the tibia is displaced.	The foot is usually normal in its direction, and the tubercle of the tibia points forwards.
POSITION OF LIMB.	
The limb is semiflexed, as a rule.	The limb is often extended, but *may* be rotated and slightly flexed.
DIAMETERS OF JOINT.	
The *antero-posterior* diameter of the joint is usually increased at one side.	The *lateral* diameter of the joint is usually augmented.
FIBULA.	
The head of the fibula is displaced.	The head of the fibula is normal in its relation to the tibia.

SYMPTOMS IN COMMON.

Both may be associated with lateral displacement of patella.
" " " " normal length of limb.
" " " " impaired motion.
" " " " a history of accident.

DISLOCATION OF PATELLA INWARDS.	DISLOCATION OF PATELLA OUTWARDS.
FREQUENCY.	
A very rare accident.	A common form of injury.
ORIGIN.	
Occurs from falls upon some projecting body which drives the patella forcibly inwards.	Occurs often in muscular efforts, as in springing sideways to avoid an accident, from wrestling, or it may follow injury from sudden falls upon the knee, especially if the inner side of the patella be struck.
CAPSULAR LIGAMENT.	
The capsular ligament is *always lacerated*, and, if the dislocation be complete, extensively injured. (Experiments of Streubel.)	The capsular ligament *may* escape laceration, even if the dislocation be complete.
REDUCIBILITY.	
Is reduced with great difficulty from tension of the ligaments.	Is reduced easily.

SYMPTOMS IN COMMON.

Both are associated with *increased breadth* of the knee.
" " " " slight flexion.
" " " " fixation of the joint.
" " " " marked pain on communicated attempts at motion.
" " " " abnormal anterior aspect of joint.
" " " " abnormal lateral projection of edge of the patella.

ROTARY DISLOCATION OF PATELLA.	UPWARD DISLOCATION OF PATELLA.
Origin.	
Occurs most frequently from direct blows upon the patella, when the knee is bent, but it has been known to occur from muscular action in jumping.	Occurs either from violent muscular effort to prevent *falling backwards* which results in rupture of the inferior ligament of the patella, or from traumatic division of this ligament.
Position of Limb.	
The limb is forcibly extended and the knee joint is immovable.	The limb cannot be voluntarily extended, nor bear the slightest weight upon it.
Position of Patella.	
The patella is twisted so that its lateral borders take the position of its upper and lower borders. The outer edge is frequently buried between the condyles.	The patella is carried upwards upon the anterior surface of the femur, and a marked hollow exists below it at the anterior aspect of the joint.
Reducibility.	
The patella is reduced with difficulty. It is performed either by forcible flexion of the knee, by pressure upon the edges of the bone when the leg is extended, or by cutting the tendon of the quadriceps extensor muscle. Occasionally the joint has to be opened and an elevator used to replace the bone.	Is reduced easily by elevation of the heel and strong extension upon the quadriceps extensor muscle.

DISLOCATIONS AT THE ANKLE.

The astragalus may be displaced from its normal situation between the malleoli of the tibia and the fibula, in one of five different directions, as follows :

A. Dislocation of the ASTRAGALUS FORWARDS, the bone slipping partially or wholly out of its attachments to the bones of the leg.

B. Dislocation of the ASTRAGALUS BACKWARDS.

C. Dislocation of the ASTRAGALUS OUTWARDS, the internal malleolus being often fractured, and the deltoid ligament either ruptured, or put upon extreme tension.

D. Dislocation of the ASTRAGALUS INWARDS, the external malleolus being usually fractured.

E. Dislocation of the ASTRAGALUS UPWARDS between the two bones of the leg, causing their separation, and increased circumferential measurement of the joint. (This dislocation is very rare.)

Of these dislocations the last three are liable to be associated with fracture, since in the *outward* or *inward* displacements the malleoli are frequently chipped off by the astragalus as it is twisted from its normal position, and in the *upward* displacement the fibula is frequently fractured by the wedge-like action of the astragalus as it is driven between the bones of the leg.

Dislocations of the astragalus are to be diagnosed

1. From each other.
2. " fracture of both bones.
3. " severe sprain of joint.
4. " congenital deformities.
5. " acquired "

DISLOCATION OF ASTRAGALUS BACKWARDS.	DISLOCATION OF ASTRAGALUS FORWARDS.
LENGTH OF FOOT.	
The foot is markedly shortened.	The foot is markedly lengthened.
PROMINENCE OF THE HEEL.	
The heel is made prominent.	The heel projection is diminished.
ABNORMAL TUMOR.	
The articular surface of the astragalus is felt behind the malleolus.	The articular surface of the astragalus is felt in front of the joint.
TENDO ACHILLIS.	
The tendo Achillis is tense and prominent.	The tendo Achillis is relaxed and concave.
DISPLACEMENT OF MALLEOLI.	
The malleoli are displaced forwards and downwards towards the sole of the foot.	The malleoli are displaced backwards and downwards towards the sole of the foot.
APPEARANCE OF THE TOES.	
The toes are flexed.	The toes are drawn upwards.
POSITION OF THE HEEL.	
The heel is elevated.	The heel is depressed.

SYMPTOMS IN COMMON.

Both may be associated with *crepitus* from fracture of the malleoli.
" are associated with alteration in the axis of the foot to that of the leg.
" " " " alteration in the length of the foot.
" " " " impaired function of the joint.
" " " " local pain and swelling often.
" " " " history of an accident.

DISLOCATION OF ASTRAGALUS UPWARDS.	FRACTURE OF BOTH BONES.
SEAT OF FRACTURE.	
The fibula is usually fractured, but **the tibia** is intact as a rule.	*Both bones* are felt to be displaced, and often the line of fracture can be perceived in each.
POSITION OF MALLEOLI.	
The malleoli are carried downwards towards the sole of the foot.	The relation between the malleoli and the sole of the foot is normal.
MOBILITY OF ANKLE.	
The mobility at the ankle joint is greatly impaired.	The ankle joint has freedom of movement.
CIRCUMFERENCE OF JOINT.	
The circumference of the ankle joint is greatly increased.	The ankle corresponds in circumference with its fellow.
BREADTH OF JOINT.	
The breadth of the ankle joint is greatly increased.	The breadth of the ankle joint is normal.
PAIN AND SWELLING.	
Great pain and swelling are present within the joint.	Pain, swelling and ecchymosis exist at the seat of fracture.
CREPITUS.	
If the fibula is not fractured no crepitation will exist.	Crepitation is very marked and easily obtained.

SYMPTOMS IN COMMON.

Both are associated with shortening of the leg.
" " " " severe pain.
" " " " marked and rapid swelling.
" " " " crepitus, as a rule.
" " " " history of an accident.

DISLOCATION OF ASTRAGALUS EXTERNALLY.	DISLOCATION OF ASTRAGALUS INTERNALLY.
SOLE OF FOOT.	
The sole of the foot is turned outwards.	The sole of the foot is directed inwards.
SEAT OF FRACTURE.	
The internal malleolus is often fractured.	The external malleolus is usually fractured.
SWELLING AND PAIN.	
The swelling and tenderness are most marked over the internal malleolus, and are due both to fracture and rupture of the *deltoid ligament.*	The pain and tenderness on pressure, as well as the swelling, are usually most marked at the external malleolus.
ABNORMAL TUMOR.	
The articular surface of the astragalus is often felt underneath the internal malleolus.	The articular surface of the astragalus is perceived underneath the external malleolus, if the dislocation be complete.

SYMPTOMS IN COMMON.

Both are associated with crepitation, as a rule.
" " " " local pain and swelling.
" " " " impaired function of the joint.
" " " " a history of accident.
" " " " an abnormal attitude of foot.

DISLOCATION AT ANKLE.	SEVERE SPRAIN.
CREPITATION.	
Crepitus is frequently detected from a fracture of the malleolus.	Crepitation is never present in simple sprain.
ATTITUDE OF JOINT.	
An abnormal attitude of the foot is present even under an anæsthetic.	The foot will assume a normal position, if the pain is relieved by an anæsthetic.
TIME OF THE APPEARANCE OF DEFORMITY.	
The deformity appears immediately after the occurrence of the accident.	Some interval of time may elapse before the deformity appears, even though the accident be severe.
MOBILITY OF THE JOINT.	
The mobility of the joint may be seriously impaired even under anæsthetics.	The normal mobility of the joint will be revealed by anæsthetics.
EFFECT OF REST.	
The symptoms and deformity are not affected by rest, and are only relieved by a reduction.	The symptoms often subside on rest and local applications.

SYMPTOMS IN COMMON.

Both may be associated with severe local pain.
" " " " constitutional disturbance.
" " " " extensive swelling.
" " " " altered attitude of joint.
" " " " impaired function of joint.
" " " " impaired mobility.
" " " " a history of accident.

DISLOCATION OF ANKLE.	CONGENITAL OR ACQUIRED DEFORMITY OF ANKLE, WITH INJURY.
History of Patient.	
A normal joint has previously existed.	A history of previous deformity will be present.
Condition of the Bones.	
The bones will be normal in development.	The bones will probably be distorted.
Mobility of Joint.	
The normal movement in tarsus and metatarsus will be perceived.	Anchylosis may exist in the smaller articulations, from disuse.
Reducibility.	
The deformity can be reduced easily, as a rule.	The deformity will probably resist all well-directed attempts at reduction.
Condition of Muscles.	
The muscles of the region will exhibit no unnatural conditions, save, possibly, laceration.	Atrophy and contracture of certain muscles, or sets of muscles, will doubtless exist if the deformity be of long standing.
Appearance of Integument.	
No abnormal thickening of integument will be discovered.	An abnormal thickening of the integument, or a cushion of fat will have been developed, if locomotion has been admitted of upon the deformed member.

FRACTURES.

FRACTURES.

By the term "Fracture," is meant "a solution of the continuity of a bone."

The varieties of fracture possible to long bones may be

A. Simple Fracture, where the bone is normal, save at the direct seat of the fracture, and the surrounding tissues are uninjured.

B. Compound Fracture, where the seat of the fracture communicates with the external air.

C. Comminuted Fracture, where the bone is broken into fragments of small size.

D. Multiple Fracture, where the shafts of long bones are broken in several distinct localities.

E. Complicated Fracture, where either joints, vessels, muscles, cavities, or organs are involved.

F. Incomplete Fracture, called also the "green-stick" fracture, where the fracture is incomplete but is still apparent from abnormal direction of the bone, or from a false point of motion existing.

G. Impacted Fracture, where the fragments of the injured bone are driven into each other by a continuation of the force producing the original injury.

The *flat bones*, when injured, may present the following varieties of fracture:

A. Simple Fracture, where the bone is not displaced from its normal position, or the surrounding tissues involved.

B. Depressed Fracture, where a displacement of the bone's fragments exists.

C. Comminuted Fracture, where separate fragments of the bone are detached from their normal position.

D. FISSURES OF BONE, where a bone is simply split, without displacement.

E. PUNCTURED FRACTURE, where a sharp instrument depresses or loosens a circumscribed portion only of the injured bone.

F. "FRACTURES BY CONTRE-COUP," where a force directly applied produces, by *transmission*, a fracture at a point remote from the seat of direct injury.

As we deal, however, almost exclusively with fractures of *long bones*, save in injuries of the cranium, and as the particular forms of fracture pertaining to flat bones will be considered in detail under the "Injuries of the Head," I shall, hereafter, in speaking of fracture, confine my remarks to fracture of the long bones only.

Fracture of long bones may be divided, also, according to the *direction* of the line of fracture, into

1st. LONGITUDINAL FRACTURE.

2d. TRANSVERSE FRACTURE.

3d. OBLIQUE FRACTURE.

SYMPTOMS OF FRACTURE.

The general symptoms of fracture common to most of its varieties may be thus enumerated:

1. CREPITUS, by which term is meant a peculiar grating sensation, perceived by the touch and, in some cases also, by the ear, on approximating the fragments and causing them either to rub together, or rotate upon each other. This symptom may in cases of impaction, or in parts deeply imbedded in tissues, possibly be undetected, but when present it is a most characteristic and positive evidence of the existence of a fracture.

2. A FALSE POINT OF MOTION. This symptom of fracture may also be undetected in some cases, especially in the incomplete and longitudinal varieties. It may also be unperceived, or imperfectly recognized when fractures occur in the immediate vicinity of joints, which are deeply imbedded in muscles,

and where, for that reason, the exact point from which motion proceeds can easily become a subject of question, or of doubt. In these cases, however, the simultaneous appearance of crepitation is often of the greatest diagnostic value, even if the crepitation be in itself obscure.

3. DEFORMITY. Fractures, as a rule, are characterized by marked deformity. Especially is this the case when the fractured bone is superficial in its situation, and the seat of injury uncovered by muscular tissue.

   The extent of the deformity depends partly upon the relation of the insertion of muscles to the seat of fracture, though it may also be influenced by the variety of injury received, and by the region of the body at which the fracture is located.

4. IMPAIRED FUNCTION OF THE LIMB, OR PART AFFECTED. This symptom is modified greatly by circumstances. It is not a positively diagnostic indication of fracture, as a severe contusion, or sprain will often produce an equal effect upon the usefulness of a member or some special anatomical region.

5. LOCALIZED PAIN. The seat of pain is often indicative of the location of a fracture, although by pressure upon nerve trunks by displaced fragments, a sense of extreme pain may occasionally be produced at a part distant from the actual seat of injury.

6. LOCALIZED SWELLING AND TENDERNESS TO PRESSURE. This symptom, if associated with the previously mentioned local pain in the same locality, is of value as a *confirmatory* evidence, provided there be sufficient reason to suspect the existence of a fracture; but it is of *little actual diagnostic value* in itself, as it may be associated with any accident resulting in inflammatory changes.

7. POSSIBLE CHANGE IN THE LENGTH AND AXIS OF THE LIMB. It is not infrequent in both dislocation and fracture, that alteration does occur both in the normal *length* and in the *axis* of the injured member. In

fact, so common is this deformity in both, and so seldom does it exist without them, that it becomes at once a most important diagnostic symptom in either.

Dislocation can, however, in obscure cases be often excluded by the partial or complete immobility of the limb, and by the difficult reduction of the deformity.

8. ECCHYMOSIS. This is liable to occur when a force is applied to produce a fracture that would more than suffice to result in a severe contusion. It can therefore be considered of confirmatory value only in the diagnosis of fracture.

Fracture as a general surgical condition can be confounded in diagnosis only with dislocation or severe contusion.

The *special fractures* are to be diagnosed, however, from the various surgical conditions liable to affect that particular region of the body where the fracture may exist. These will be considered in connection with the various parts of the body, and in the following order:

A. FRACTURES OF THE SKULL.
B. " " FACE.
C. " " SHOULDER.
D. " " HUMERUS AT SHOULDER.
E. " AT THE ELBOW JOINT.
F. " " WRIST "
G. " " HIP "
H. " " KNEE "
I. " " ANKLE "
J. " " TRUNK.

I pass first then to the consideration of the diagnoses pertaining to fractures of the skull.

FRACTURES OF THE SKULL.

The skull may be fractured either at its convexity, sides, or base.

Fractures of the skull may result from direct or indirect violence. They may be either simple, depressed, comminuted, compound, fissured, or punctured in variety, and may be classified on a basis either of their *location* or of the mode of their *origin.*

I prefer, however, to enumerate without any special basis several forms of fracture of the skull, which often demand a special diagnosis, and which are indicated by a modification of the symptoms common to the ordinary varieties of fracture.

Fractures of the skull can be thus divided into

A. FRACTURES OF THE OUTER TABLE ONLY, in which type a *depression* of the bone is perceived, but no symptoms of *compression of the brain* are produced. It is a frequent form of fracture, and, when the depression is slight in degree, ordinary examination will usually fail to detect it provided the scalp is not lacerated, as it is often masked by swelling of the scalp and the periosteal covering.

B. FRACTURE OF THE OUTER, MIDDLE AND INNER TABLES, constituting the so-called "fracture with *depression*, and with symptoms of *compression* of the brain." This form is frequently associated with laceration of the scalp and periosteum, and can be readily diagnosed by a careful digital examination, and by the rational symptoms of the patient.

C. FRACTURE OF THE INNER TABLE ONLY, constituting "fracture with *symptoms of compression* of the brain, but with the absence of external depression."

This class of injury can seldom be positively diagnosed, save by exclusion.

It is to be differentiated from traumatic concussion of the brain, from meningeal hemorrhage, and from a possible apoplectic attack associated with traumatism.

D. "FRACTURE BY CONTRE-COUP," or "FRACTURE BY TRANSMITTED FORCE." This usually occurs from violence applied to some portion of the cranium where the bone is of extreme

thickness, as at the occiput or the parietal eminence. The most frequent seat of this type of fracture is undoubtedly at the base of the skull, though the frontal region and the temporal region may also be fractured by transmission of force applied at a seat remote from these localities.

The *outline* of fractures resulting from contre-coup is usually of the stellate, or radiating type.

E. PUNCTURED FRACTURES OF THE SKULL. This type of fracture is the result of direct injury received from a pointed instrument. It may consist of a distinctly *circumscribed* depression of a *small* portion of bone, or a radiating fracture with a marked indentation at the *seat* of the injury. Its surgical importance rests chiefly upon the cerebral disturbance immediately resulting *from* it, and also in the peculiar tendency which this class of fractures possesses in developing *epilepsy*, and *diseases* dependent on *cerebral irritation* or *pressure* in later years.

F. FISSURES OF THE SKULL. This variety of injury is often undetected during life if the scalp or the periosteum be *not* involved.

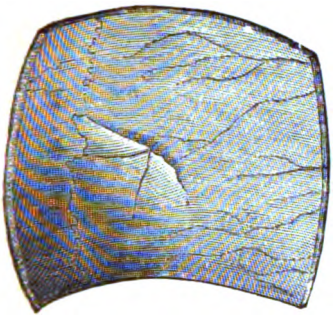
In that case, the symptoms of a complicating *hemorrhage* of the meninges of the brain, or the development of symptoms of local abscess within the *skull* at the seat of injury, might give grounds for a reasonable conjecture of the existence of a fracture.

When the scalp and periosteum are involved, however, the *edge* of the fissure can often be detected by the finger nail, or by a careful examination by a probe.

Frequently, however, an incised wound of the periosteum, if cleanly cut, may resemble a fissure of the bone so closely, that nothing but an enlargement of the superficial wound will enable the surgeon to make a positive exclusion of fracture.

G. ELEVATED FRACTURE. This form of fracture, where the fragment is forced outwards is rare, but is still supported by several reported specimens. Two such specimens are now exhibited in the St. George's Hospital Museum. It is usually due to some pointed instrument, acting as a lever after it has punctured the skull.

PLATE XIV.



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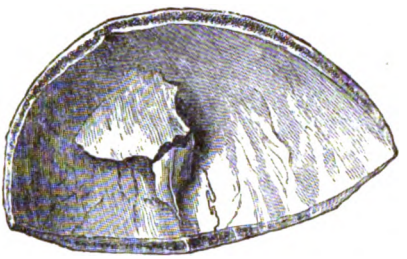

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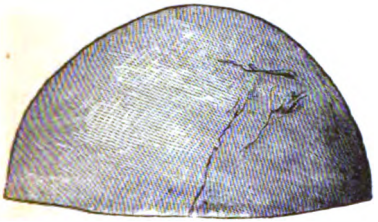

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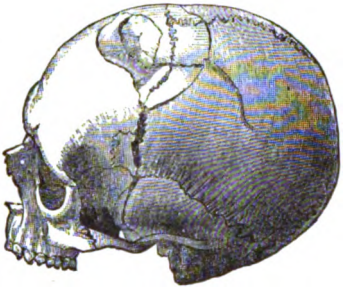

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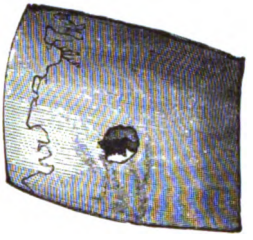

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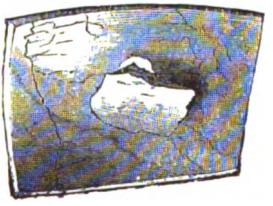

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1, 2. Depression of inner table of skull. 3. Fissure of outer table of skull. 4. Fracture and depression of outer table of skull. 5. Hernia cerebri. 6. Punctured gun-shot fracture from a pistol ball. 7. Inner plate, showing the extensive depression.

H. FRACTURE OF THE BASE OF THE SKULL. Fracture at the base of the skull is usually the result of transmitted violence, either through the spinal column, by falls upon the feet, or by direct violence to the occiput, producing fracture by "contre-coup." Its peculiar symptoms are the only means of diagnosis, as no digital examination can, of course, be made; but the results of the fracture are so distinctly apparent in the appearance of the patient and the local and general manifestations present, that little doubt as to diagnosis can exist, provided the fracture is extensive.

Fractures of the skull in general can hardly be confounded with any other surgical condition, save *contusion* or a *laceration of the pericranium*, in the latter of which the possibility of fissure or *masked* fracture may be suspected, or the existence of such wrongly diagnosed from the rigidity of the periosteal wound, its marked outline, and its traumatic origin.

I have added to the following set of diagnostic tables, appertaining purely to fractures of the skull, the symptoms of cerebral compression and concussion in contrast, as they must, of necessity, be mentioned in generalities in connection with fracture, and are of too great surgical importance to be incompletely given.

FRACTURE OF SKULL (COMPLETE).	FRACTURE OF THE OUTER TABLE.
Appearance of the Fracture.	
The seat of fracture, on examination, usually reveals a projecting edge of bone in the healthy or uninjured portion; or an apparent orifice opening into the cavity of the cranium may possibly be perceived.	The depressed portion of the bone merges gradually into the surrounding parts; no free or well-defined edge being discovered on palpation.
Mobility of Fragments.	
The depressed portion of the bone is frequently movable.	The depressed portion of the bone exhibits *no mobility* as a rule.
Condition of Scalp.	
The soft tissues are usually lacerated.	The soft tissues are frequently not involved.
Symptoms of Compression.	
Symptoms indicative of cerebral compression are usually present, if the amount of depression at the seat of fracture is excessive.	Symptoms indicative of cerebral compression never exist.

SYMPTOMS IN COMMON.

Both may be associated with a history of injury to the head.
" " " " external symptoms of contusion.
" " " " depression of bone.

FRACTURE OF OUTER TABLE.	FRACTURE OF INNER TABLE.
Depression and Crepitus.	
External evidences of injury to the skull are present on palpation; and possible crepitus may be detected.	No external evidences of injury of the skull are discovered.
Cerebral Symptoms.	
No symptoms of cerebral compression, or cerebral irritation are present.	Brain symptoms are usually present indicative of cerebral compression, or cerebral irritation.
Convulsions.	
Convulsions are seldom if ever produced.	Convulsions of the epileptic type are liable to result as sequelæ; or they possibly may exist at the time of the injury.

SYMPTOMS IN COMMON.

Both are associated with a history of injury to the head.
" *may* be " " external symptoms of contusion.
" " " " constitutional disturbance.

FRACTURE OF INNER TABLE.	APOPLEXY, WITH INJURY.
PREVIOUS HISTORY.	
No symptoms of a cerebral character have existed.	A history of cerebral symptoms, as syncope, coma, vertigo, aphasia, etc., may have existed.
ATHEROMA.	
No arterial atheroma can be perceived.	Atheroma of the superficial vessels may be detected.
BRAIN SYMPTOMS.	
Coma, paralysis, stertorous breathing, irregularity of the pupils, and other symptoms of compression *may* be absent, or may appear some time after the injury. Symptoms also of simple local pressure on special nerves may exist.	Symptoms of cerebral compression will usually be well marked, if the hemorrhage has been sufficient to produce a state of sudden coma, or of injury from falling, and will *usually* exist from the *commencement* of the attack.
SKIN.	
The skin may not be markedly altered.	The skin is usually flushed, especially in the region of the head.
AGE.	
May occur at any age.	Occurs usually after 40th year of age.

SYMPTOMS IN COMMON.

Both may be associated with injury of the scalp.
" " " " absence of external evidences of depression of bone.
" " " " cerebral symptoms, such as convulsions, coma, paralysis, etc.

FRACTURE OF THE BASE OF SKULL.	CEREBRAL CONCUSSION.
CONDITION OF INSENSIBILITY.	
Delirium is frequently present, of a noisy character and associated with jactitation.	The patient is usually in a state of coma from which he can be only partially aroused.
The special senses are often unaffected.	The special senses act feebly.
The state of coma if present tends to increase and deepen.	The coma tends to decrease rapidly.
TEMPERATURE.	
The temperature is normal, or elevated.	The temperature is lowered.
PARALYSIS.	
Paralysis is often present.	Paralysis is absent.
ESCAPE OF BLOOD.	
Blood escapes from the ears, nose, or mouth; and an escape of the cerebro-spinal fluid also takes place from the ears, if the petrous portion of the temporal bone be fractured.	No blood or cerebro-spinal fluid escapes from the ear, nose, or mouth.
ECCHYMOSIS.	
Sub-conjunctival ecchymosis appears in lower eyelid within 24 hours after the injury as a rule.	No *ecchymosis* is present, unless dependent on direct traumatism.

SYMPTOMS IN COMMON.

Both may be associated with a history of indirect violence.
" " " " coma.
" " " " alteration in temperature.
" " " " impairment of special senses.

CEREBRAL COMPRESSION.	CEREBRAL CONCUSSION.
INSENSIBILITY.	
The coma is profound.	The coma is incomplete.
" " may not directly follow the injury.	" " " usually immediate.
" " is stationary or increasing.	" " rapidly decreases, as a rule.
The special senses are in abeyance.	The special senses act feebly.
TEMPERATURE.	
The temperature is normal, or increased.	The temperature is lowered.
MOTION AND SENSATION.	
Motion or sensation can be each affected separately, or in common. Hemiplegia, occasionally paraplegia, or local paralysis may be present. Convulsions, in severe cases, may exist, with paralysis on the side opposite.	Paralysis is absent. The limbs are simply weak and flaccid.
PULSE.	
The pulse is usually *full* and *slow*.	The pulse is *feeble, rapid* and *intermittent*.
RESPIRATION.	
The breathing is slow and *stertorous*.	The breathing is feeble and *sighing* in character.
EYELIDS.	
The eyelids are usually closed and immovable.	The eyelids are usually open and movable.
PUPILS.	
The pupils are either natural, dilated, or irregular; but they are always sluggish and show decreased sensibility to light.	The pupils are usually *contracted;* but they act feebly, and are generally sensible to light.

CEREBRAL COMPRESSION (*continued*).	CEREBRAL CONCUSSION (*continued*).
SPHINCTERS.	
The urine is retained as a rule, and the bowels are obstinately constipated.	Incontinence of urine and involuntary evacuations occur.
STOMACH.	
Vomiting is rare.	Vomiting is frequently present, as the effects of concussion pass away.

SYMPTOMS IN COMMON.

Both may be associated with coma.
" " " " " abnormal temperature.
" " " " " abnormal pulse.
" " " " " abnormal respiration.
" " " " " abnormal pupils.
" " " " " history of an injury.

FRACTURES OF THE UPPER JAW.

The superior maxillary bone may be fractured either through direct violence, or from injury indirectly transmitted. It is frequently complicated with laceration of the face, and the gums are, in the majority of cases, involved. It may be either of the simple, compound, or comminuted varieties.

Little error can possibly exist in diagnosis, save when the fracture is masked by severe swelling, and unassociated with any injury to the mucous membrane of the mouth. In such an event, the reduction of the swelling will disclose the existence of a probable deformity, although even in the absence of displacement, or before the swelling can be reduced, a possible *crepitus* may be detected through the swollen parts, and thus an early diagnosis can positively be made.

The embarrassment to mastication would probably be also less marked in contusion, than if a complicating fracture were present, and this alone should be a valuable guide in case justifiable doubt exist.

The deformity, in case of fracture of the superior maxillary bone, varies somewhat with the seat of fracture and the form of violence to which it is due.

The face will usually be seen to present a markedly altered appearance, when contrasted with the healthy side, and the laceration of the gums, the displaced teeth, their imperfect articulation with those of the lower jaw, and a possible fissure along the hard palate, will attract even the patient's attention, from the abnormal sensations produced.

FRACTURES OF THE LOWER JAW.

The lower jaw may be fractured either in its body, ramus, condyle, or coronoid process.

The fracture may be transverse, or oblique in direction; unilateral or bilateral in situation; simple, compound, or comminuted in variety. It is almost invariably the result of direct violence.

If the fracture occur at the ramus, slight deformity will exist. If at the condyle, the chin will be deflected towards the injured side, in which respect it differs from *dislocation* of the bone, and an abnormal hollow will exist behind the ear.

If the coronoid process be fractured, displacement of the fragment

by the temporal muscle will ensue, and the separated portion of the bone will be felt to be so displaced by examination of the injured bone through the mouth.

In fractures of the body of the inferior maxillary bone, the anterior fragment is usually displaced either to the inside of the posterior fragment, or below it.

The mobility of the fragments is most marked in the bilateral variety, while in the fracture of the condyle, and also that of the body of the jaw, the rigidity of the bone is markedly decreased. In fracture of the *ramus*, however, and also in that of the coronoid process, the bone retains nearly its normal power of resistance, save in those cases where comminution exists, in which case great mobility is often present.

Fractures of the lower jaw are liable to be mistaken for dislocation of that bone only, as no other surgical condition can present symptoms which could possibly lead to error.

FRACTURE OF LOWER JAW.	DISLOCATION OF JAW.
LINE OF THE TEETH.	
The line of the teeth is often irregular.	The teeth are perfectly normal.
GUMS.	
The gums are often lacerated.	The gums are never involved.
BLEEDING.	
Bleeding from the mouth is common.	Bleeding from the mouth is rare.
CREPITUS.	
Crepitation can be detected at the seat of fracture.	Crepitation is usually absent, but it *may* be felt at the coronoid process.
MOTION.	
The movements at the articulations are normal.	The movements of the jaw are restricted.
DEPRESSION AT EAR.	
No depression exists in front of the ear.	A depression is present over the glenoid fossa.
TUMOR.	
No tumor is present at the cheek.	The coronoid process, when displaced, becomes prominent.
CHIN.	
The chin is normal in position.	The chin is deflected to the side in the unilateral variety; and displaced forwards in the bilateral variety.

SYMPTOMS IN COMMON.

Both are associated with loss of the power of mastication.
" may be associated with dribbling of saliva.
" " " " impairment of power of articulation.
" are " " deformity.
" " " " history of traumatism.

FRACTURES AT THE SHOULDER.

The fractures at the shoulder include all varieties liable to exist either in the Scapula, Clavicle, or Humerus.

The scapula is seldom, if ever, fractured through indirect violence. A severe accident is usually required to cause serious injury to the bone, as it is protected by its muscular coverings, except at the acromion, coracoid, and spinous processes.

The scapula may present the following varieties of fracture:

A. FRACTURE OF THE BODY OF THE SCAPULA.
B. " " NECK " "
C. " " ACROMION PROCESS.
D. " " CORACOID "
E. " " SPINOUS "

Fractures of the scapula are to be diagnosed

1. From each other.
2. " contusion.
3. " fracture of the neck of humerus.
4. " dislocation of the humerus.

From contusion the diagnosis of fracture of the body of the scapula is made chiefly on the presence of crepitus, on localized pressure being made over different portions of the bone. We may have, however, in extensive comminution a change also in the relation of the fragments, on pressure outwards being made upon the angle of the scapula when the shoulder is fixed, and possibly even the edges of the separate fragments may be detected through the investing muscles.

Auscultation also is of value, as crepitus may often thus be perceived from the movements of the fragments during inspiration, as a result of the action of the *serratus muscle*, when it cannot be detected on palpation.

The other points of differential diagnosis pertaining to fractures of the scapula will be found enumerated in the following pages.

FRACTURE OF THE BODY OF THE SCAPULA.	FRACTURE OF THE SPINE OF THE SCAPULA.
Relation of the Fragments.	
The fragments of the bone can, in some cases, be felt to overlap each other.	Overlapping of the fragments, if present, cannot be discerned, as the muscles attached to the spinous fossæ conceal the displacement.
Pain.	
The local pain is markedly increased by pressure, coughing and by movements of the arm.	The pain is increased by the motions involving the deltoid and trapezius muscles, but is not affected by coughing to any perceptible degree.
Crepitus.	
Crepitus can be detected often by fixation of the shoulder and movement being communicated to the lower angle of the scapula, or by direct palpation when the arm is moved.	Crepitus is slightly marked, and often absent.
Bony Prominences.	
The acromion, coracoid and spinous processes are normal. No fracture of the humerus can be detected, and still crepitation and pain on motion exist.	The acromion process *may* reveal abnormal mobility, if the spine is greatly comminuted; and an irregularity in the spine can be detected often by the finger.

SYMPTOMS IN COMMON.

Both are associated with a history of severe contusion.
" " " " restricted and painful motion of arm.
" " " " absence of the symptoms of fracture of the humerus.
" " " " local pain and swelling over the scapula.

FRACTURE OF THE NECK OF SCAPULA.	FRACTURE OF THE NECK OF HUMERUS.
Prominence of the Acromion.	
The acromion process is very prominent.	The acromion process is usually normal in its appearance.
Hollow below Acromion.	
A hollow exists below the acromion process, but less marked than in dislocation downwards into the axilla.	No hollow exists *immediately* below the acromion process.
Coracoid Process.	
The coracoid process moves with the humerus, and not with the scapula.	The coracoid process moves with the scapula, and not with the humerus.
Crepitus.	
Crepitation is detected by raising the elbow, and rotation of the humerus while the other hand is placed upon the shoulder.	Crepitation is detected by extension and subsequent rotation, or by carrying the elbow inwards, while extension is continued.
Reducibility.	
Reduction of the deformity is produced by raising the elbow.	Reduction is effected by simple extension of the arm.
Length of Arm.	
The arm is lengthened.	The arm is shortened.

SYMPTOMS IN COMMON.

Both are associated with a history of violence.
" " " " easy reduction and crepitus.
" " " " a marked tendency towards return of the deformity.
" " " " severe pain in shoulder, and often in the hand.
" " " " marked swelling in shoulder, and often in the hand.
" " " " change in length of arm.

FRACTURE OF THE NECK OF SCAPULA.	DISLOCATION OF HUMERUS.
LENGTH OF LIMB.	
The arm is lengthened.	The arm *may* be lengthened or shortened.
REDUCIBILITY.	
The reduction is easy and is effected by simply raising the elbow.	The reduction is difficult and is effected by extension and manipulation.
The reduction is transient when the force is not maintained.	The reduction is permanent if once accomplished.
ELBOW.	
The elbow can be made to touch the side.	The elbow of the affected limb cannot be approximated to the chest.
AXIS OF LIMB.	
The axis of the injured limb is parallel with the median line of the body.	The axis of the affected limb is abnormal.
CREPITATION.	
Crepitation is present.	Crepitation is absent.
MOBILITY.	
Abnormal mobility exists at the shoulder.	Impaired mobility of the affected side is present.

SYMPTOMS IN COMMON.

Both are associated with a history of traumatism.
" " " " prominence of the acromion.
" " " " a hollow beneath the acromion.
" " " " change in the length of the arm.
" " " " local pain and swelling.
" " " " impaired function.

FRACTURES OF THE CLAVICLE.

The clavicle may be fractured in one of three situations:

1. At the sternal end.
2. In its body.
3. At its acromial end.

The varieties of fracture which may affect the clavicle are the simple, compound (very rare), comminuted and the incomplete.

Fractures of the clavicle are more often met with in surgical practice than those of any other bone in the body excepting the radius. They most frequently occur from indirect violence, especially from falls upon the shoulder, or upon the hand when the arm is outstretched; although the bone may be broken from violence directly applied, and, in rare cases, from muscular action.

The most frequent seat of fracture of the clavicle is near the middle of the bone. The acromial end comes next in frequency, while those of the sternal end are comparatively rare.

When the bone is fractured near its middle, the inner fragment is usually retained in nearly its normal position by the strong ligaments located at its sternal end which prevent great latitude of movement, and by the muscles attached to that portion which are nearly counterbalanced. It may however be elevated in position.

Fractures of the clavicle are extremely common in youth, nearly one-half of all the cases occurring before the fifth year terminates. When adults are subjected to fracture, the preponderance of males affected to females is large, although among children the sexes seem to be equally subject to the accident.

Fractures of the clavicle are associated with many symptoms that are *common* to all of its varieties to a greater or less degree; among these may be mentioned: 1, local pain; 2, impaired motion of arm in the antero-posterior direction; 3, inability to touch the head without assistance; 4, inclination of the neck and head towards the affected side, and 5, a desire to support the elbow of the affected limb. These symptoms are usually present whether the displacement is marked, or very slight in degree, and are of diagnostic value when the finger of the surgeon cannot positively detect any apparent irregularity in the line of the injured clavicle.

It is seldom, however, that the clavicle is broken without giving in itself distinctive signs of deformity; still when the bone is transversely broken, between the conoid and the trapezoid ligaments, by which the clavicle is bound to the coracoid process of the scapula, no displacement occurs, and the line of the clavicle affords no outward evidence of injury, save by the rational symptoms mentioned above.

FRACTURE OF CLAVICLE INSIDE OF THE CORACOID PROCESS.	FRACTURE OF THE CLAVICLE OUTSIDE OF THE CORACOID PROCESS, NEAR THE CONOID LIGAMENT.
Deformity.	
A marked deformity is present, due to the projection of the inner fragment, and the displacement of the outer fragment downwards, forwards and inwards.	The deformity which exists is slight. The finger can only detect a slight irregularity in the fractured bone.
Appearance of Shoulder.	
The shoulder is sunken and drawn inwards towards the chest.	The shoulder is normal in its appearance and position.
Length of Clavicle.	
The clavicle is shortened.	The clavicle is of normal length, or possibly slightly shortened.
Position of the Arm.	
The arm is rotated inwards and hangs by the side. The forearm being usually supported by the opposite hand.	The arm is normal in its attitude and in its relations to the trunk.
Crepitus.	
Crepitation is detected on raising the arm and drawing the shoulder backwards and outwards.	Crepitation is obscure, and is detected chiefly by manipulation of the fragments.
Motion at Shoulder.	
The motion of the arm is restricted or lost, especially in the movements of elevation and circumduction.	The movements of the arm are nearly normal, unless marked displacement exists.
Pain.	
Pain is present on attempts to touch the head or the opposite shoulder with the hand of affected side.	Pain is markedly present, and located at the seat of injury.
Swelling and Ecchymosis.	
Swelling and ecchymosis are present and are especially marked if the fracture be due to direct injury.	Swelling and ecchymosis are often absent.

FRACTURES OF THE HUMERUS, NEAR THE SHOULDER JOINT.

The humerus may present at its upper third five distinct varieties of fracture which claim special surgical attention, and which often demand accuracy of diagnosis. These may be enumerated as follows:

A. SIMPLE INTRA-CAPSULAR FRACTURE, where the head of the humerus is separated by violence from the shaft of the bone within the insertion of the capsular ligament of the shoulder joint, and remains as a distinct fragment, but not entirely deprived of nutrition.

B. IMPACTED INTRA-CAPSULAR FRACTURE, where the humerus is broken in the same locality as in the preceding fracture, but where the fragments are again united by impaction of the *upper* fragment into the lower.

C. SIMPLE EXTRA-CAPSULAR FRACTURE, where the humerus is broken just below the tuberosities at its surgical neck, and where the fragments remain separated and distinct.

D. IMPACTED EXTRA-CAPSULAR FRACTURE, in which the anatomical location of the fracture is the same as that of the one preceding, but where the *lower* fragment is driven into the upper fragment of the bone, thus causing an absence of the unnatural mobility which otherwise would exist.

E. SEPARATION OF THE GREATER TUBERCLE. This is essentially a fracture of youth in which the epiphysis becomes detached from the bone, and is displaced upon the scapula by the action of the muscles inserted into its three facets.

Each of these fractures has distinctive diagnostic symptoms, and each will therefore be specially considered. Fractures of the upper end of the humerus may be confounded with each other, with fractures of the scapula, with dislocations at the shoulder joint, and with severe contusions of the deltoid region.

SIMPLE INTRA-CAPSULAR FRACTURE OF THE HUMERUS.	SIMPLE EXTRA-CAPSULAR FRACTURE OF THE HUMERUS.
ACROMION.	
The acromion process is slightly prominent.	The acromion process of the scapula is normal in its appearance.
APPEARANCE OF SHOULDER.	
The shoulder is less round than normal.	The shoulder is marked by a hollow one or two inches below the acromion.
POSITION OF ELBOW.	
The elbow easily touches the side of the chest.	The elbow stands out, but can be made to touch the chest.
LENGTH OF ARM.	
No shortening of the arm is usually detected.	The arm is markedly shortened.
MOBILITY.	
No unnatural point of motion can be perceived.	A false point of motion is clearly detected.
UPPER FRAGMENT.	
The head of the bone cannot be felt displaced.	The head of the bone is felt to be separated from the shaft, and fails to rotate with it.
CREPITUS.	
Crepitus is obtained only on careful manipulation, combined with pressure over the joint and rotation of the arm.	Crepitation is marked on extension being applied to the arm, and the elbow being carried inward towards the chest.
PAIN AND SWELLING.	
Pain and swelling are present in the vicinity of the joint only.	Pain and swelling are present both at the seat of fracture, and often in the hand and fingers.

SIMPLE INTRA-CAPSULAR FRACTURE OF THE HUMERUS (*continued*).	SIMPLE EXTRA-CAPSULAR FRACTURE OF THE HUMERUS (*continued*).
ECCHYMOSIS.	
Ecchymosis is infrequent.	Ecchymosis is usually present.
DISPLACEMENT.	
The lower fragment only is displaced inwards.	The upper fragment is displaced upwards and outwards, and the lower fragment inwards.

SYMPTOMS IN COMMON.

Both are associated with a history of injury.
" " " " crepitus.
" " " " altered appearance of shoulder.
" " " " pain and swelling.

IMPACTED INTRA-CAPSULAR FRACTURE OF THE HUMERUS AT SHOULDER.	IMPACTED EXTRA-CAPSULAR FRACTURE OF THE HUMERUS AT SHOULDER.
ACROMION.	
The acromion process is quite prominent.	The acromion process is normal, or very *slightly* prominent.
HOLLOW AT SHOULDER.	
The hollow beneath the acromion is marked.	No hollow beneath the acromion is present.
LENGTH OF ARM.	
The arm is shortened.	The arm is normal in length, as a rule.
HUMERUS.	
An irregularity in the upper part of the humerus is felt in the axilla.	An abnormal condition of the bone is often undetected.
RELATION OF FRAGMENTS.	
The relation of the head of the bone to the shaft is often altered.	The relation of the fragments is frequently a normal one.
CREPITUS.	
Crepitation, if present, is due usually to comminution of the great tuberosity, in which case, pressure over it, combined with rotation of the arm will give crepitus.	Crepitation is usually obscure, and if obtained, it is perceived by holding the joint firmly, while an assistant rotates the arm, with the forearm flexed.
MOTION.	
Motion is greatly impaired, but is not entirely lost.	The use of the arm is entirely lost, in the majority of cases.
PAIN AND SWELLING.	
Pain is severe, but little swelling is present.	Great pain and marked swelling and ecchymosis are usually present.

SYMPTOMS IN COMMON.

Both are associated with a history of traumatism.
" " " " impaired function of limb.
" " " " local pain and swelling.
" " " " crepitation, in some instances.
" " " " frequent prominence of the acromion.

FRACTURE OF THE NECK OF THE HUMERUS.	SUB-GLENOID DISLOCATION.
Depression at the Shoulder.	
An *indistinct* hollow exists at a short distance below the acromion.	A distinct hollow exists immediately below the acromion.
Acromion Process.	
The acromion process is not markedly prominent.	The acromion process is pointed and very prominent.
Axillary Tumor.	
An irregular and pointed tumor is felt low down in the axilla: (lower fragment).	A large, smooth and rounded tumor is felt high up in the axilla: (displaced head of humerus).
Crepitus.	
Crepitus is easily obtained by extension and movement of the arm.	Crepitus is usually absent.
Length of Arm.	
The length of the arm is shortened.	The length of the arm is increased.
Position of Elbow.	
The elbow can easily be made to touch the chest.	The elbow cannot be approximated to the chest.
Axillary Walls.	
The axillary walls are normal.	The anterior fold of the axilla is prominent.
Reducibility.	
Reduction is easily accomplished, but transient if the force be not maintained.	Reduction is difficult, but permanent when once effected.
Communicated Motion.	
Communicated motion, under anæsthetics, is free.	Communicated motion is limited in its extent.
History.	
Is usually the result of direct violence.	Is produced by falls upon the hand or elbow when removed from the chest; or by a direct blow, downwards, upon the upper part of the humerus.

FRACTURE OF NECK OF THE HUMERUS.	FRACTURE OF THE NECK OF THE SCAPULA.
ACROMION.	
The acromion process appears normal.	The acromion process is very prominent.
HOLLOW BELOW ACROMION.	
No hollow exists *immediately* below it, but one may exist lower down.	A hollow exists *immediately* under the acromion process which is well marked.
CORACOID PROCESS.	
The coracoid process is immovable, save with scapula.	The coracoid process moves with the humerus, and not with the scapula.
CREPITUS.	
Crepitation is perceived on extension of the arm and carrying the elbow towards the chest.	Crepitation is detected by raising the elbow, and rotation of the arm when the hand of the surgeon grasps the shoulder.
REDUCIBILITY.	
Reduction is effected by direct extension of the arm.	Reduction is effected by raising the elbow.
LENGTH OF ARM.	
The arm is shortened.	The arm is lengthened.

SYMPTOMS IN COMMON.

Both are associated with a history of traumatism.
" " " " crepitus.
" " " " easy reduction, but of a transient character.
" " " " loss of motion.
" " " " severe pain in the shoulder and hand.
" " " " marked swelling in the shoulder and hand.
" " " " a change in the length of the arm.

SEPARATION OF THE GREAT TUBERCLE OF THE HUMERUS.	SUB-SPINOUS DISLOCATION OF THE HUMERUS.
TUMOR ON SCAPULA.	
A small tumor is felt upon the scapula, which, however, fails to rotate with the shaft of the humerus.	A large, round tumor is detected upon the scapula, which participates in all the motions communicated to the shaft of the humerus.
AGE AFFECTED.	
Is liable to occur only in youth.	Is present in all stages of life.
GLENOID CAVITY.	
The glenoid cavity is found to be filled.	The glenoid cavity is found empty.
ACROMION AND CORACOID.	
The acromion and coracoid processes are not markedly prominent.	The acromion and coracoid processes are very prominent.
POSITION OF ELBOW.	
The elbow can be approximated to the chest.	The elbow cannot be approximated to the chest.
CAPABILITIES OF MOVEMENT.	
The hand can be made to touch the top of the head, and can be placed upon the opposite shoulder.	The hand cannot be made to touch the top of the head, or be placed upon the opposite shoulder.
REDUCIBILITY.	
The reduction of the deformity is effected by rotation of the arm outwards, combined with pressure over the fragment.	The reduction of the deformity is effected by extension of the arm and manipulation.
RETURN OF DEFORMITY.	
The deformity shows a marked tendency to return, when the force is discontinued.	The reduction is permanent if once effected.

SYMPTOMS IN COMMON.

Both are associated with a tumor on the scapula.
" " " " absence of crepitus.
" " " " impaired functions.
" " " " history of an accident.
" " " " local pain in region of the shoulder.

FRACTURES AT THE ELBOW.

The fractures which occur in the vicinity of the elbow joint may be confined either to the lower end of the humerus, or to the upper ends of the ulna and the radius.

The humerus at its lower third may be fractured in five distinct localities, to each of which surgical attention may be directed, and of each of which an accurate diagnosis can generally be made. These five varieties of fracture can be thus enumerated:

A. FRACTURE OF THE OUTER CONDYLE OF THE HUMERUS. In which the separation of the outer condyle becomes apparent at the external aspect of the joint and the movements of the *radius* may possibly be interfered with.

B. FRACTURE OF THE INNER CONDYLE OF THE HUMERUS. In which the separation is felt as a movable fragment at the inner aspect of the joint, and symptoms, referable to injury of the ulnar nerve, may possibly exist in the hand and along the internal border of the forearm.

C. TRANSVERSE FRACTURE ABOVE THE CONDYLES. In this variety of fracture a displacement of the forearm participates in the injury and many symptoms arise leading towards suspicion of a dislocation of both bones of the forearm backwards upon the humerus. It is by no means an infrequent form of fracture, and is liable, in some cases, to become *compound* in variety from perforation of the integument.

D. THE SO-CALLED T-SHAPED FRACTURE, consisting of the above-named transverse fracture of the humerus complicated with a fissure running downwards between the condyles and frequently involving the joint.

E. FRACTURE OF THE EPITROCHLEAR PROCESS OF THE HUMERUS, which can often be detected as a small, detached and movable fragment.

Fractures of the humerus near the elbow are to be diagnosed

1st. From each other.

2d. " dislocation at the elbow.

3d. " fracture of the ulna or radius.

4th. " severe sprain or contusion of the joint.

FRACTURES OF THE ULNA, AT THE ELBOW.

The ulna if fractured in the vicinity of the elbow may be broken either in its shaft, below the coronoid process, or the olecranon and coronoid processes may be individually fractured.

Fractures of the ulna as a single bone in the vicinity of the elbow are more commonly a complication of dislocations at the elbow joint than a primary affection. The bone if broken by ordinary violence is usually affected in its shaft, either in the forearm at its middle, or nearer the wrist joint.

In fact it is difficult for the ulna to be fractured at either of its processes in the vicinity of the elbow joint without displacement occurring at the same time, since no longer does any barrier exist to prevent the bone from slipping from its articulating surface. It can only be, then, in cases of a severe form of violence directly applied to the bone that uncomplicated fracture of the ulna in the vicinity of the elbow can occur.

As I propose to consider all the diagnoses pertaining to fractures in the vicinity of the elbow in consecutive order, I pass to the enumeration of the fractures of the radius.

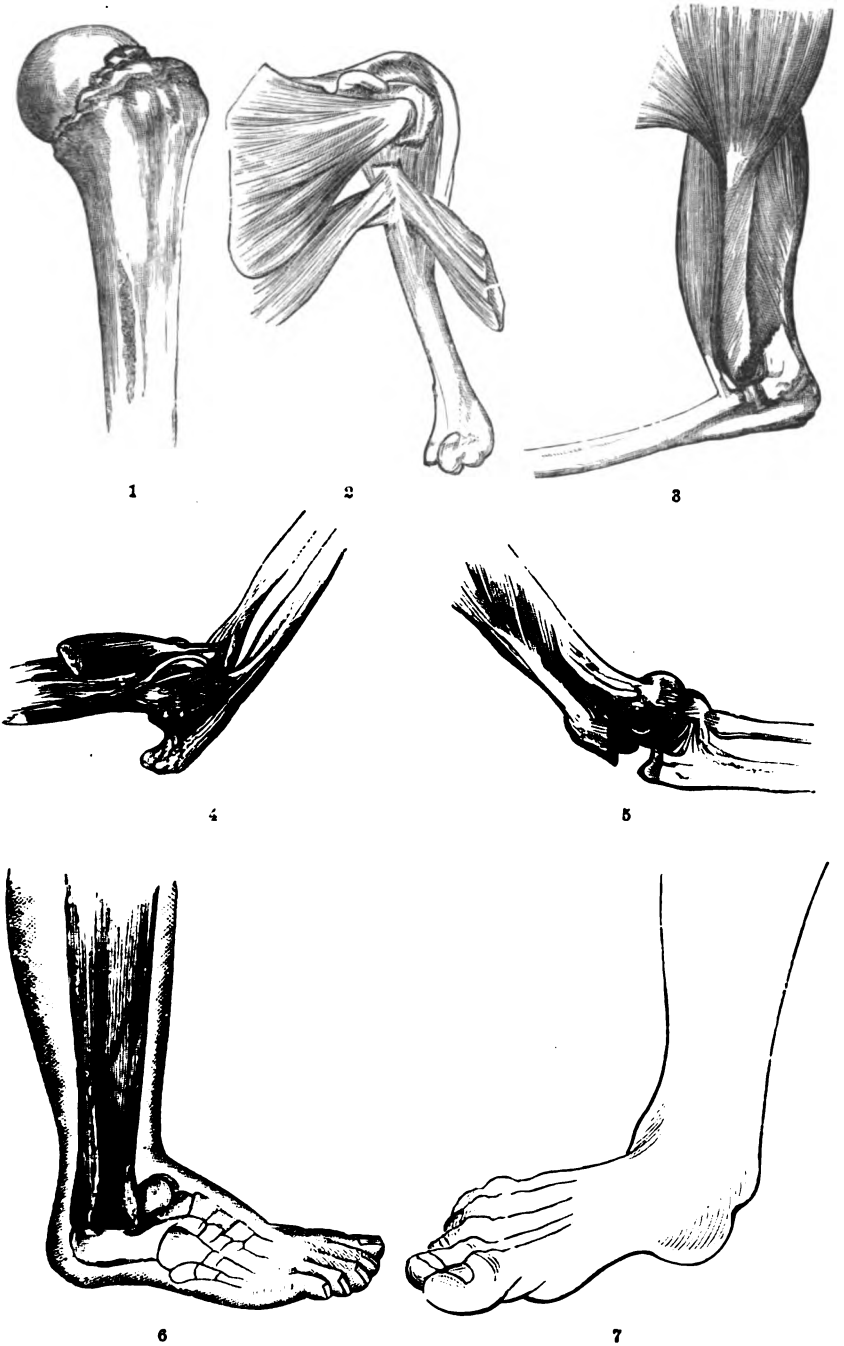
FRACTURES OF THE RADIUS, AT THE ELBOW.

The radius is seldom fractured in the vicinity of the elbow, as an individual bone. It is more commonly associated with fractures of the ulna occurring from direct violence.

It may however be broken either below its articular head, or immediately below its tubercle.

If below the tuberosity, the seat of fracture becomes at once apparent from the action of the biceps muscle upon the upper fragment of the bone.

PLATE XV.



1. Fracture of anatomical neck of humerus. 2. Fracture of surgical neck of same. 3. Fracture of same above its condyles. 4. Fracture of coronoid process of ulna with dislocation. 5. Fracture of olecranon process of same. 6. Fracture of leg bones with dislocation of tarsus. 7. Deformity of Pott's fracture.

TRANSVERSE FRACTURE OF HUMERUS ABOVE THE CONDYLES.	DISLOCATION OF BOTH BONES OF FOREARM BACKWARDS.
HISTORY.	
Occurs in falls upon the elbow.	Occurs in falls upon the palm of the hand, or upon the forearm when the humerus is fixed.
ANTERIOR TUMOR.	
An anterior tumor exists which is small and pointed (upper fragment), and lies *above* the crease of the elbow.	An anterior tumor exists (lower end of humerus), which is broad and large, and lies *below* the crease of the elbow.
POSTERIOR TUMOR.	
A posterior tumor is felt which is large, and discloses the outlines of the condyles and the olecranon.	A tumor is felt posteriorly which discloses the distinct outlines of the two displaced bones of the forearm.
OLECRANON.	
The olecranon is in its normal relation to the condyles of the humerus.	The olecranon is separated from the condyles of the humerus.
MOBILITY.	
Extensive mobility is present.	The joint is usually immovable.
CREPITUS.	
The crepitus, which is always detected, is of the *grating* character, characteristic of fracture.	Crepitus may be absent, or, if present, is of a *rubbing* character.
LENGTH OF HUMERUS.	
The humerus is shortened, if measured from the acromion to the external condyle.	The humerus is of normal length, as revealed by the same measurements.
REDUCIBILITY.	
Reduction of the deformity is easy by simple extension, but is transient if the force be removed.	The reduction of the deformity is difficult, but permanent when effected.

SYMPTOMS IN COMMON.

Both are associated with *shortening* of the *upper extremity* (as a whole).
" " " " an anterior and posterior tumor.
" " " " impairment of function.
" " " " a history of an accident.
" " " " possible crepitus.
" " " " local pain and swelling.

FRACTURE OF OUTER CONDYLE OF HUMERUS.	FRACTURE OF INNER CONDYLE OF HUMERUS.
CHANGE IN CONDYLE.	
The prominence of the outer side of the elbow is lost, and a movable fragment is perceived.	The prominence of the internal aspect of the joint is lost, and a movable fragment is felt.
RELATIONS OF BONES OF FOREARM.	
The radius is frequently displaced from its normal position.	The ulna is usually retained in its normal relation to the humerus.
NERVE SYMPTOMS.	
No symptoms due to injury of nerves are liable to be present.	Symptoms due to injury of the ulnar nerve usually exist in the forearm and hand.

SYMPTOMS IN COMMON.

Both are associated with a *displacement of the fragment* towards the posterior surface of the joint during extension of the forearm; but on flexion the displacement tends to disappear.

Both are associated with a *prominence of the humerus* at its lower extremity at the seat of fracture during extension of the forearm, which also disappears on flexion.

Both are associated with *pain* on flexion and extension.

" " " " *imperfect* or *impaired motion* in the elbow.

" " " " *crepitus*, by pressure being made over the fractured condyle, and flexion and extension being performed.

" " " " history of an accident.

" " " " local swelling and tenderness on pressure.

FRACTURE OF CORONOID PROCESS OF THE ULNA.	FRACTURE OF THE OLECRANON PROCESS OF THE ULNA.
HISTORY.	
A history of indirect violence, as in falls upon the palm, exists.	A history of direct violence, as in falls upon the elbow when the arm is bent, is present.
PRESENCE OF DISLOCATION.	
It is rarely unassociated with dislocation of the ulna or of both bones backwards.	It may occur without displacement of the ulna, or the ulna may be dislocated forwards.
DISPLACEMENT.	
The displacement is often very slight if dislocation be absent. A simple *fulness* in front of the joint and a small, hard, movable body are all that are discovered.	The amount of displacement varies with the extent of injury done to the triceps expansion over the olecranon. If dislocation is present, a special deformity will be produced which will be characteristic.
DEFORMITY.	
The condyles and the projecting olecranon are normal and preserve the shape of the joint.	The point of the elbow is gone and the arm is usually semi-flexed, though the fragments are often closely approximated on extension of the forearm.
CREPITUS.	
Crepitation is often absent, but when present it is perceived on extension and *local* pressure in front of the joint being exerted.	Crepitation is detected by extension of the forearm, and rubbing the fragments together.
MOTION.	
Flexion at the elbow is always impaired, if the radius be dislocated.	The power of extension of the forearm is entirely lost.

SYMPTOMS IN COMMON.

Both are associated with deformity.
" " " " possible dislocation.
" " " " impaired function.
" " " " crepitus.
" " " " history of an accident.
" " " " local pain and swelling.

FRACTURE OF THE OLECRANON PROCESS OF THE ULNA.	RUPTURE OF THE TRICEPS TENDON.
Tumor.	
The tumor on the back of the arm is of bony hardness.	The tumor at the back of the arm, due to contraction of the triceps, is not *bony* in character.
Length of Olecranon.	
The length of the olecranon is diminished.	The olecranon process is of normal length.
Relations of Olecranon.	
The olecranon no longer is adherent to the ulna, nor are its relations to the condyles of the humerus normal.	The olecranon process is adherent to the ulna, and is normal in its relation to the condyles.
Crepitus.	
Crepitus can be detected by extension of forearm and manipulation.	No crepitus can be detected.
Pain and Swelling.	
The pain and swelling are often severe.	The swelling and inflammatory symptoms are slight.

SYMPTOMS IN COMMON.

Both are associated with *loss of the power of extension of the forearm.*
" " " " an *empty space* behind the elbow.
" " " " a *tumor* high up behind the joint.
" " " " a history of traumatism.
" " " " local pain.
" " " " local swelling.

FRACTURE OF THE UPPER END OF THE RADIUS.	FRACTURE OF THE UPPER END OF THE ULNA.
DEFORMITY.	
No displacement of the upper fragment will exist, if the seat of fracture be above the tubercle of the radius; but if below it, a *marked displacement* is apparent on extension of the forearm, from tension of the biceps tendon.	A displacement will be easily detected, as a rule, on the posterior part of the forearm, on account of the superficial position of the bone in that locality, although it may not be discovered on the anterior surface.
CREPITUS.	
Crepitation can be detected by fixation of the condyle, and rotation of the lower fragment of the radius.	Crepitus will be detected on rotation of the lower fragment, and possibly on flexion and extension of the forearm.
MOTION.	
Flexion is difficult, or incomplete.	The motions of the forearm may be only slightly impaired if the fracture be transverse.
POSITION OF THE HAND.	
The hand is pronated.	The hand has no *fixed* position.

SYMPTOMS IN COMMON.

Both are associated with a history of traumatism.
" " " " marked swelling.
" " " " severe local pain.
" " " " frequent ecchymosis.
" " " " crepitus.
" " " " impaired function and motion.
" " " " altered, or a fixed position of the hand.

FRACTURES NEAR THE WRIST JOINT.

The fractures which may occur in the vicinity of the wrist joint are as follows:

A. "COLLES' FRACTURE," by which term is meant that peculiar type of fracture of the radius located from $\frac{3}{4}$ of an inch to $1\frac{1}{2}$ inches from its lower articular extremity, and associated with the so-called "silver-fork" deformity.

It is usually of the impacted variety of fracture, the upper fragment being driven into the lower fragment, which is therefore frequently comminuted. It is also associated often with an outward displacement of the hand and wrist.

It results most frequently from falls upon the palm of the hand when the arm and the forearm are *extended*.

B. "BARTON'S FRACTURE," by which term is meant a rare type of fracture located at the lower articular extremity of the radius, in which the styloid process of that bone and an adjacent portion of the articulating surface of the radius are separated from the shaft of the bone, and the wrist joint opened. This form of fracture is so extremely rare, that I know of but two bony specimens indicative of its previous existence in the various anatomical museums. It can be doubtless easily overlooked during life, as the fragments are too low down to admit of great displacement, and crepitation might easily be absent. As the condition is one of extreme infrequency little is known of its symptoms, save on theoretical speculation.

C. FRACTURE OF BOTH BONES OF FOREARM, TRANSVERSELY near the wrist. This type of fracture is by no means uncommon. It may occur from indirect violence applied to the hand, carpus, or forearm; or from a direct blow received over the seat of injury. It is to be diagnosed from *Colles' Fracture* and from dislocation of the carpal bones.

D. SEPARATION OF THE EPIPHYSES AT THE WRIST. Like all sepa-

rations of the epiphyses of bones, this accident occurs in youth.

It may result from direct or indirect violence; and is to be diagnosed from transverse fracture of both bones, and from dislocations of the carpus.

E. Fracture of the Lower End of the Ulna. This variety of fracture may be confined simply to the styloid process of the ulna, or the shaft of the bone in the immediate vicinity of the wrist joint may be involved. It can hardly be confounded with any other surgical condition, save contusion, when the swelling conceals the deformity, and when crepitation is indistinct.

The fractures in the vicinity of the wrist joint are of very frequent occurrence. Probably no bone in the body is so frequently broken as the radius, and no fracture is so often brought to the surgeon's notice as that first described by Colles, and known by his name.

Fractures in the vicinity of the wrist are to be diagnosed

1. From each other.
2. " dislocations of the carpus.
3. " dislocations of the ulna, (lower end).
4. " severe sprains and contusions about the joint.

COLLES' FRACTURE.	DISLOCATION OF THE WRIST.
LOCATION OF DEFORMITY.	
The deformity present is confined to the radial side.	The deformity affects both sides of the forearm.
APPEARANCE OF RADIAL BORDER.	
The so-called "*silver fork*" appearance, due to the displacement of the fragments of the radius, is seen by examining the radial border of the forearm.	No abnormal curves in the line of the radius are perceived.
CREPITUS.	
Crepitus is present, provided impaction does not exist.	No crepitus can be detected.
TUMOR.	
An abnormal tumor is perceived on *both surfaces* of the forearm, which is both sharp and pointed.	An abnormal tumor is present on only one surface of the forearm, which is smooth and rounded.
LENGTH OF RADIUS.	
The radius is shortened.	The radius is normal in length.
LENGTH OF LIMB.	
The limb is normal in length upon the *ulnar* side.	The limb is shortened on both the radial and ulnar sides.
STYLOID PROCESSES.	
The styloid process of the ulna is lower than that of the radius.	The styloid process of the ulna is *higher* than that of the radius.
The styloid process of the ulna is markedly prominent from displacement of the carpus.	The styloid process of the ulna is not markedly prominent.

SYMPTOMS IN COMMON.

Both are associated with an alteration in the length of the limb.
" " " " an abnormal tumor.
" " " " local pain and swelling.
" " " " impaired function.
" " " " a history of an accident.

FRACTURE OF BOTH BONES NEAR THE WRIST.	DISLOCATION OF THE WRIST.
SEAT OF DISPLACEMENT.	
The seat of displacement is located above the styloid processes.	The seat of displacement is located at the carpal articulation.
DEFORMITY.	
The bony projection or tumor is rough and irregular.	The bony tumor is smooth and rounded.
The inferior projection is long, as it includes the carpus and lower fragments.	The inferior projection is *short*, as it includes only the carpus.
CONDITION OF TENDONS.	
The tendons of both surfaces of the forearm are relaxed.	The tendons upon one surface of the forearm are tense.
STYLOID PROCESSES.	
The styloid processes are not prominent, and are normal in their relations to the carpus.	The styloid processes are prominent, and are abnormal in their relation to the carpus.
LENGTH OF FOREARM.	
The radius and ulna are both shortened.	The radius and ulna are both of normal length.
MOBILITY.	
Great mobility exists at the seat of fracture.	Partial fixation of the joint is present.
CREPITUS.	
Crepitation is present.	Crepitation is absent.
REDUCIBILITY.	
Reduction is easily made by extension, but the deformity returns.	Reduction is more difficult, but is permanent if once accomplished.

SYMPTOMS IN COMMON.

Both are associated with deformity near the wrist.
" " " " impaired function.
" " " " local pain and swelling.
" " " " a history of an accident.
" " " " shortening of the limb (as a whole).

SEPARATION OF THE EPIPHYSES.	DISLOCATION AT THE WRIST.
AGE AFFECTED.	
Occurs only in the young.	Occurs at any age.
BONY TUMOR.	
The bony projections are often indistinct and can be felt as two smooth tumors.	The bony projection is distinct and can be felt as a rounded mass.
SEAT OF DISPLACEMENT.	
The displacement occurs above the styloid processes of the radius and the ulna.	The displacement occurs below the styloid processes of the radius and the ulna.
TENDONS OF THE FOREARM.	
The tendons are relaxed upon both surfaces of the forearm.	The tendons are *tense* upon one side of the forearm.
LENGTH OF FOREARM.	
The bones of the forearm are shortened, on measurement from condyles at elbow to styloid processes.	The bones of the forearm are normal in length.
STYLOID PROCESSES.	
The styloid processes of the ulna and the radius are not prominent, but are normal in their relation to the carpus.	The styloid processes of the radius and ulna are prominent.

SYMPTOMS IN COMMON.

Both are associated with the *absence of crepitus.*
" " " " *shortening of the upper extremity.*
" " " " *smoothness of the tumor* at the wrist.
" " " " impaired function.
" " " " local pain and swelling.
" " " " easy reduction.
" " " " a history of an accident.

COLLES' FRACTURE.	TRANSVERSE FRACTURE OF BOTH BONES ABOVE WRIST.
DEFORMITY.	
The deformity is apparent upon the radial side, and has the characteristic "*silver-fork*" appearance.	The deformity is apparent on both sides of the forearm.
LENGTH OF BONES OF FOREARM.	
The ulna is normal in length, but the radius is shortened.	Both sides of the forearm reveal shortening.
LENGTH OF LIMB.	
The limb is shortened on the radial side, if measured from the acromion to the styloid process.	The limb is shortened on both sides, if measured from the acromion to the styloid processes.
STYLOID PROCESSES.	
The styloid process of the ulna is prominent.	The styloid processes are both normal in their appearance and relations.
CREPITUS.	
Crepitus is often absent from impaction of the fragments.	Crepitus is almost invariably present, as impaction is rare.
MOBILITY.	
The mobility is not markedly increased at the seat of fracture.	Excessive mobility exists at the seat of fracture.
RELATION OF CARPUS.	
The carpus is usually displaced outwards.	The carpus is normal in its relation to the inferior fragments.
REDUCIBILITY.	
The reduction is sometimes difficult.	The reduction is always easy, if simple extension is applied.

SYMPTOMS IN COMMON.

Both are associated with deformity at wrist.
" " " " impairment of function.
" " " " alteration in the length of bones.
" " " " crepitus.
" " " " local pain and swelling.
" " " " history of an accident.

FRACTURES OF THE HIP.

The femur is the bone most frequently involved in injury to the hip joint.

The pelvic bones are too heavy and solid in their structure to often become implicated, save when the violence is terribly severe and so directed as to impinge upon the ossa innominata.

The femur may exhibit the following five distinct types of fracture in the upper third of that bone:

A. SIMPLE INTRA-CAPSULAR FRACTURE OF THE FEMUR. This form of fracture occurs at the anatomical junction of the head of the bone to its neck, inside of the attachment of the capsular ligament of the hip joint. It is most commonly present in the aged, and is usually the result of indirect and slight violence.

It is seldom followed by osseous union, and is often a permanent source of impairment to the usefulness of the limb.

B. IMPACTED INTRA-CAPSULAR FRACTURE OF THE FEMUR. In this form of fracture the location is identical with the fracture preceding, but the condition of the bone is altered by the *lower* fragment being driven forcibly into the cancellous tissue of the head of the femur.

Impaction of the fragments in intra-capsular fracture of the hip is of great surgical importance. Upon its existence depends greatly the hope of osseous union, and the prognosis is proportionately favorable when impaction can be clearly and positively diagnosed. *R. W. Smith, of Dublin*, in his great essay upon fractures in the vicinity of joints, questions if osseous union is *possible* in any other condition save impaction, provided the fracture of the femur be located within the capsule of the hip joint.

C. SIMPLE EXTRA-CAPSULAR FRACTURE OF THE FEMUR. This form of fracture of the femur is usually the result of a direct form of violence which is generally severe in

character. It is most common in middle or adult life. Its location varies from a point immediately in relation with the capsular attachment, to a line corresponding to the junction of the middle and lower third of the bone.

It is associated, as a rule, with marked deformity, great impairment of function of the injured limb, and severe local manifestations.

D. IMPACTED EXTRA-CAPSULAR FRACTURE OF THE FEMUR. This form of fracture differs but little from the preceding variety in its origin or its location. It *may* possibly present equal deformity in case the impaction is oblique or incomplete; and may also be associated with severe local manifestations.

It is, however, characterized by the absence of a false point of motion, and the general impairment of function may be less marked.

In case of rotary impaction of the fragments, an abnormal position of the foot may ensue, which will frequently disappear after firm extension has loosened the impacted fragments.

E. FRACTURE OF THE GREAT TROCHANTER OF THE FEMUR. This variety of fracture occurs as a separate type in cases of falls upon the hip, and also more frequently as a complication of extra-capsular fracture of the neck of the femur.

So frequently does the trochanter become involved in this latter accident that it is considered an almost universal rule, that more or less comminution of the trochanter accompanies every fracture of the neck, from an impaction which primarily occurs, and is subsequently loosened by a continuation of the violence producing the original impaction. Should the violence, however, be slight in amount, this impaction may remain permanent and the trochanter thus escape comminution.

We may safely exclude all fractures of the *pelvic bones* from the causes of error in diagnosis of injuries received in the region of the hip joint, provided no evidences of previous disease of these bones are present, since if the fracture of these bones be severe and extensive, the location of the crepitus and symptoms referable to the pelvic viscera will easily remove all doubt. Should the fracture be of a local

character, however, and not of the comminuted variety, it is often impossible to either positively diagnose the existence of a fracture, or, provided even that crepitus be obtained, to locate its situation.

Fractures of the upper third of the femur are to be diagnosed chiefly from each other, and also from

1. The "*pubic*" dislocation of the hip.
2. The "*sciatic notch*" dislocation of the hip.
3. *Chronic rheumatic arthritis with contusion.*
4. *Severe contusion over the trochanter*, in the aged.

In the following pages will be found enumerated the chief points of diagnosis in a condensed form.

INTRA-CAPSULAR FRACTURE OF THE HIP, WITH IMPACTION.	EXTRA-CAPSULAR IMPACTED FRACTURE OF THE HIP.
History of Accident.	
A history of slight violence and usually of the indirect character is present, in the majority of cases.	A history of severe violence, directly applied, exists.
Position of Foot.	
The foot is markedly everted.	The foot is slightly everted, or normal in its attitude.
Crepitus.	
Crepitus is frequently detected, as the fragments may overlap and rub upon the acetabulum.	Crepitus is either absent, or is very obscure.
Effect of Extension.	
Extension relieves the shortening of the limb.	Extension, when moderately applied, fails to relieve the deformity.
Age.	
Is most frequent in old age.	Is most frequent in adult life.

SYMPTOMS IN COMMON.

Both are associated with shortening of the limb.
" " " " eversion of the foot.
" " " " local pain near seat of fracture.
" " " " swelling and possible ecchymosis.
" " " " a history of an accident.
" " " " a possible crepitus.

INTRA-CAPSULAR FRACTURE OF THE HIP.	CHRONIC RHEUMATIC ARTHRITIS WITH CONTUSION.
History.	
No previous history of disease of the hip, or impairment of the function of that joint is present.	A previous history of pain, deformity about the joint, and impairment of function, precedes the accident.
Subsequent Power.	
The patient slowly, if ever, regains the power present within the joint previous to fracture.	The patient regains the amount of power and motion which he possessed within the hip previous to the accident, as soon as the effects of the contusion disappear.

SYMPTOMS IN COMMON.

Both are associated with crepitus.
" " " " loss of power and loss of voluntary motion.
" " " " local pain in the region of the hip.
" " " " swelling and possible ecchymosis.
" " " " a history of an accident.
" " " " advanced years.
" " " " eversion of the foot.

SIMPLE INTRA-CAPSULAR FRACTURE OF THE HIP.	SIMPLE EXTRA-CAPSULAR FRACTURE OF THE HIP.
AGE AFFECTED.	
Is rarely present in patients under fifty years of age.	May occur at all ages.
SEX AFFECTED.	
Is most frequent in females.	Both sexes are equally affected.
HISTORY.	
Is the result of slight and indirect violence.	Is usually associated with severe and direct violence.
SHORTENING.	
The shortening of the limb is at first not severe, but it steadily tends to increase, from absorption of bone.	The shortening of the limb is *markedly* apparent immediately after the occurrence of fracture, but is stationary.
FALSE POINT OF MOTION.	
A false point of motion is obscure.	A false point of motion is apparent.
CREPITUS.	
Crepitation is obscurely detected.	Crepitation is well marked.
POWER OF MOTION.	
The power of motion of the limb is always impaired, but not always destroyed.	The power of motion within the limb is usually *lost.*
ARC OF ROTATION.	
The trochanter rotates in nearly its normal arc.	The arc of rotation of the trochanter is diminished, as the femur is detached from its neck.
PAIN.	
Pain of a *slight* but *deep* character is present.	Pain of a *severe* and *superficial* character is present.

SIMPLE INTRA-CAPSULAR FRACTURE OF THE HIP (*continued*).	SIMPLE EXTRA-CAPSULAR FRACTURE OF THE HIP (*continued*).
ECCHYMOSIS.	
Ecchymosis is usually slight or absent.	Ecchymosis is usually extensive.
SWELLING.	
Swelling is not markedly apparent.	Swelling is frequently severe.
RAPIDITY OF UNION.	
Union occurs slowly, if at all.	Union occurs rapidly and perfectly, as a rule.

SYMPTOMS IN COMMON.

Both are associated with the history of an accident.
" " " " impairment of function.
" " " " shortening of the limb.
" " " " crepitus.
" " " " pain and possible ecchymosis.

FRACTURE OF THE HIP WITH INVERSION OF THE FOOT.	"SCIATIC NOTCH" DISLOCATION OF THE FEMUR.
MOBILITY OF LIMB.	
The mobility of the injured member is increased.	The mobility of the limb is greatly decreased.
CREPITUS.	
Crepitus is present.	Crepitus is absent.
SHORTENING.	
Shortening of the limb is well marked.	Shortening of the limb exists only to a *slight* degree.
INVERSION OF THE FOOT.	
The inversion of the foot is often changed to eversion, after extension of the limb has loosened the impaction of fragments, to which the inversion is most frequently due.	The inversion of the foot is permanent, and is only restored to a normal position by reduction of the dislocation.
ABNORMAL TUMOR.	
The separated trochanter often fails to participate in the motions of the shaft of the femur.	The abnormal tumor produced by the displaced head of the femur rotates with motion communicated to it through the shaft of that bone.
REDUCIBILITY.	
The reduction of the deformity is easily effected by extension, but is transient if the force be not maintained.	The reduction of the deformity is difficult, but when once accomplished no tendency to return is manifested.
HISTORY OF ACCIDENT.	
Is often produced by indirect violence.	Is usually produced by direct violence.

SYMPTOMS IN COMMON.

Both are associated with *shortening* of the limb.
" " " " *inversion of the foot.*
" " " " local pain in the region of the hip.
" " " " impairment of function.
" " " ", swelling, and possible ecchymosis.
" " " " history of an accident.

FRACTURE OF THE NECK OF THE FEMUR.	"PUBIC" DISLOCATION OF THE FEMUR.
POSITION OF THE TROCHANTER.	
The trochanter of the femur is *normally prominent*, and is not displaced towards the median line of the body.	The trochanter of the femur is carried forwards, and is much less prominent than normal.
POSITION OF THE HEAD OF FEMUR.	
The head of the bone is felt to be in the acetabulum.	The head of the femur is felt as an abnormal tumor in the groin, at its upper portion.
CREPITUS.	
Crepitus can easily be detected.	No crepitus is present.
MOBILITY OF LIMB.	
The *mobility* of the injured limb is increased, but its power of motion is greatly impaired or entirely destroyed.	The mobility of the limb in the movements of *adduction* and *rotation inwards* is greatly impaired.
REDUCIBILITY.	
The reduction of the deformity is easily accomplished by direct extension, but is transient if the force be discontinued.	The reduction of the deformity is difficult, but if once effected no tendency towards a return is apparent.

SYMPTOMS IN COMMON.

Both are associated with *eversion of the foot.*
" " " " *shortening of the limb.*
" " " " *impaired function.*
" " " " severe local pain.
" " " " history of traumatism.

FRACTURES AT THE KNEE AND ANKLE.

The fractures which may occur at the region of the knee may be confined either to the femur in its lower third, to the tibia and fibula at the upper portion of both bones, or to the patella.

The *femur* if fractured either in its middle or lower third is generally broken by some form of direct violence. In its lower third, it is liable to present the following types of fracture:

A. Fracture of the outer condyle.

B. " " inner "

C. Transverse fracture above the condyles.

D. "T-shaped" fracture.

These fractures of the femur in this region are generally easily detected by the deformity and the location of the crepitus.

It is not infrequent that fractures of the femur in this vicinity are complicated by wounds of the knee joint, and amputation is often required provided extensive comminution exists, or the symptoms of the patient seem to demand it.

Impaction in these fractures is occasionally present, and, provided comminution of the lower fragment does not ensue, this impaction may not be associated with any serious deformity.

FRACTURES OF THE BONES OF THE LEG IN THE VICINITY OF THE KNEE.

The tibia, although the stronger and larger bone of the leg, is by far the more frequently fractured.

This is partly due to its exposed position, but chiefly to the fact that the fibula is extensively protected by muscles. The tibia, also, is much more liable to receive injury from violence transmitted through the heel and the tarsus, than the fibula.

The variety of fracture which is most frequently present at the upper third of the tibia is the transverse, and *this* seldom, if ever, occurs except from the application of direct violence.

If both bones are simultaneously involved, the presence of crepitus, marked deformity, false point of motion, and shortening renders the diagnosis easy; but if either is fractured singly, the opposite

bone acts as a splint, and prevents displacement and shortening. In this case an irregularity in the line of the tibia can easily be detected by the finger, if that bone be fractured; but if the fibula be broken, the investing muscles render the diagnosis obscure, provided the seat of fracture be above the middle third of the bone.

A deep-seated crepitus can, however, be often detected by careful manipulation, and the seat and presence of fracture be thus discovered.

Fractures of the bones of the leg in the region of the knee can hardly be mistaken for any other existing surgical affection. Contusion may possibly so mask the symptoms of fracture by its accompanying swelling as to leave doubt as to whether the bone is broken, but it could hardly be mistaken for it.

FRACTURES OF THE PATELLA.

Fractures of the patella most frequently occur from muscular action in an effort being made by the patient to save himself from falling when slipping, or in falls when the knee is bent. It may, however, also occur from falls directly upon the knee, or from any other form of violence directly applied.

Fractures of the patella may be transverse, longitudinal, or oblique in direction; and simple, or comminuted in variety. The transverse fracture is usually the form met with when due to muscular action, and is by far the one most frequently present in surgical practice.

The fractures of the patella can hardly be mistaken for other forms of injury, when they are well defined. The two portions of the bone, in case of transverse fracture, are separated by the action of the quadriceps extensor muscle, and the space between the fragments is increased by flexion of the knee. All power to extend the leg upon the thigh is lost, and endeavors to stand upon the injured leg are fruitless. In the comminuted variety local crepitus can usually be discerned, but in the transverse form, the fragments can hardly be sufficiently approximated to yield marked crepitus, except the position of the thigh be so modified as to relax the rectus muscle, and extension be applied to the upper fragment of the bone.

Fractures of the patella are more common among males than females, and are seldom present in youth. This is explained on the theory of previous structural change within the bone substance,

(*Malgaigne*), but it can hardly be considered as proven. A better explanation of the frequency of fracture of this bone seems to be the *lack* of support which the upper half of the patella receives when the knee is in a state of flexion, as in this position the upper edge is projected forwards, and the posterior surface of the *upper half* of the bone is totally separated from contact with the femur.

FRACTURES AT THE ANKLE.

The fractures which may occur in the bones of the leg at their lower third, or in the immediate vicinity of the ankle joint are more common than those occurring in the immediate vicinity of the knee. This is partly due to the bones gradually diminishing in size as they approach the ankle, and partly to the greater frequency of indirect violence occurring in the vicinity of that joint from transmission through the bones of the foot, and from the leverage exerted by the astragalus upon the malleoli of the leg bones, in case of its displacement.

Fractures of the leg in the vicinity of the ankle may be thus enumerated:

A. Transverse Fracture of Both Bones. This form of injury is perhaps less common than the oblique variety of fracture which is so frequently present in the shafts of the leg bones, since a natural tendency seems to exist in fractures occurring in the tibia or fibula below their upper third to approach a longitudinal direction, and thus to cause a greater or less obliquity, even if the force be so applied as to tend towards a directly transverse separation of the fragments. Still, in speaking of *transverse* fracture I include all those forms which more nearly approach the horizontal than the perpendicular plane, without entering into too many fine distinctions as to the absolute direction of the line of fracture.

In this type of fracture near the ankle, we may have either slight or marked displacement existing. The degree of this displacement is the most extensive when the fracture is obliquely directed across the bone, since in this condition the fragments glide more easily upon each other; and it is the least apparent in that form of fracture where an absolutely *transverse* separation is present, in which case the bones may often be retained

in almost their normal position, and the line of the fracture may for that reason be more clearly discerned by the location of the crepitus than from any evidence perceived by the careful inspection and examination of the contour of the injured member.

B. "POTT'S FRACTURE" OF THE FIBULA. This type of fracture is located in the shaft of the fibula, at a point usually about three inches above the external malleolus. The seat of the fracture may, however, vary somewhat in its location, as it is often much nearer the malleolus.

It is associated, as a rule, with an outward dislocation of the astragalus, and the internal malleolus is frequently broken. The internal lateral, or *deltoid ligament*, of the ankle is usually severely stretched or ruptured, and the deformity due to the displacement of the astragalus, is aggravated often by marked local swelling.

This form of fracture of the leg is extremely frequent, probably the most frequent of any fracture of the leg bones. It is produced by twisting of the foot, by catching of the foot in a hole while running, by jumping from a height upon the feet, or from a carriage while in motion. It may also result from violence directly applied.

The deformity which characterizes *Pott's Fracture*, is one of ordinary fracture combined with that of an external dislocation of the foot. A depression is perceived on the external border of the leg opposite the seat of fracture, and the sole of the foot is either directed outwards, or the external border of the foot is elevated.

The internal malleolus is either prominent, or can be felt as a detached and movable fragment; and crepitus can often be detected on extension of the leg and inversion of the foot, thus bringing the fragments into approximation.

C. FRACTURE OF THE INTERNAL MALLEOLUS. This form of fracture at the ankle may be associated with a normal position of the foot, or with a partial dislocation of the astragalus inwards, resulting either in severe stretching, or rupture of the external lateral ligament of the joint. It is complicated, as a rule, with marked swelling at the external portion of the joint, and is not infrequently

associated with a partial or complete fracture of the fibula.

D. Compound Fractures of the Ankle Joint. This form of accident is one of serious import, commonly requiring amputation if associated with dislocation or severe laceration of the soft tissues. The tibial arteries are not infrequently involved, and serious hemorrhage may exist.

Gangrene of the parts supplied by these arteries may also follow the arrest of the hemorrhage, from the defective nutrition which is liable to result in consequence of the impaired blood supply, and thus additional danger to the patient may ensue.

It is always important therefore in the diagnosis of this accident to investigate the condition of the supplying vessels to the foot, before deciding as to the methods of treatment which are best indicated, or expressing an opinion as to the general prognosis.

Fractures in general in the vicinity of the ankle joint can hardly admit of great confusion in diagnosis. Obscure injuries to the astragalus, or tarsal bones will often fail to give positive evidence of fracture, even when such exists; but the history of the accident, the general deformity, the presence of some of the prominent symptoms of fracture, and the length of duration required for recovery will, in time, remove doubt, in cases where an early and positive diagnosis is impossible.

I shall not attempt therefore to arrange all the possible fractures of the bones of the leg and foot in the vicinity of the ankle joint, in a form of contrast, since many of the most positive symptoms of each are capable of great variations, and in the majority of cases, the bones themselves will disclose from their *superficial location* the seat and extent of the injury received.

I should suggest, however, in case the deformity were slight, and the other symptoms so obscure as to create doubt as to the existing condition of the parts injured, that the opposite member be always used in comparison with the one injured, before deciding as to the actual deformity present, and that repeated examinations under anæsthetics and without them be employed, till a satisfactory conclusion can be reached.

FRACTURES OF THE TRUNK.

Fractures of the trunk may affect the vertebræ, ribs, sternum and pelvis; of these four, *fractures of the sternum* are extremely rare, and usually occur where a severe injury is received, which directly impinges upon the chest, or in cases where the body is suddenly bent backwards or forwards, as in a fall. It is of surgical importance however, when present, since complication of the pericardium, heart, pleura, lungs, and injuries of the great vessels and *fractures* of the ribs, or spine, may be also thus produced, and greatly modify, when present, the prognosis as to life.

As many of these complications, however, can also exist with fractures of the ribs, they will be specially considered under that head.

Fractures of the sternum may be associated with most of the symptoms common to fracture in general. Crepitus may be detected possibly on palpation and on auscultation.

FRACTURES OF THE STERNUM.

Displacement of the fragments, abnormal mobility, localized pain at the seat of fracture, and dyspnœa may all be present, even without the existence of any serious complication of organs or the serous cavities, though subsequent inflammatory changes are always liable to follow any violence to the chest which is sufficient to produce so serious an injury.

It is therefore to be diagnosed chiefly from its complications, and especially from inflammatory changes in the pleura or pericardium.

Fractures of the sternum have in several reported cases been produced by muscular action. *Chaussier* reports two cases resulting from resting upon the head and heels only, during parturition. *Faget* and *Gurlt* report each a case resulting from attempting to lift weights with the teeth, with the body bent backwards.

FRACTURES OF THE VERTEBRÆ.

Fractures of the vertebræ may result from direct injuries to the spine, or from force indirectly applied, as in case of falls upon the feet, knees, pelvis, or head.

In the first set of causes, viz.: those producing fracture from

direct violence, the injury is, of necessity, received upon the back, since in front the spine is most thoroughly protected.

This class of injury almost without exception results in a complicating *dislocation* of the vertebræ in addition to the fracture received, since the anterior ligamentous attachments of the bodies to each other are ruptured by the direct force of the blow, altering the *normal spinal curve*, while at the same time the spinous processes and laminæ of the vertebræ are comminuted by the *compression* exerted in endeavoring to resist such an alteration in the spinal axes.

In the second class, viz.: those dependent upon force indirectly applied to the spine, the fracture is found to be usually located at a distance from where the shock was first received. Dislocation of the vertebræ will, as a rule, be absent, but the articular surfaces will generally be comminuted, and the spinous and transverse processes frequently fractured.

In very severe cases, however, where the force transmitted through the spinal column is of a violent character, the *bodies* of the vertebræ may be comminuted, and *displacement* from this cause will often be detected.

In either variety, however, we can judge of the location of the fracture and its severity by the combined local and spinal symptoms.

The *local* symptoms will consist of probable crepitus, deformity, detached and movable fragments, local ecchymosis, and local pain.

The *spinal* symptoms will vary with the seat of fracture and the portion of the cord compressed, or injured. Thus, if above the origin of the phrenic nerve, death may ensue from respiratory paralysis, provided both lateral halves of the spinal cord are injured. If above the origin of the lumbar and sacral plexuses, symptoms of paralysis of the limbs and pelvic organs will be apparent.

The paralysis of muscles may be of the hemiplegic or paraplegic type, as the pressure on the cord is lateral or bilateral, or possibly even local paralysis may result, if special spinal nerves be affected, and the cord be not involved.

In some cases where dislocation of the vertebræ exists in connection with fracture, extension of the spine by suspension of the patient, if practicable, if not, by ordinary means, will often reduce the dislocation, and possibly an audible click will be heard when the reduction is effected.

Fractures of the spine are frequently fatal.

The result of the injury depends more upon the severity of the

spinal symptoms produced by injury to the cord, than upon the location of the fracture or its extent. If dislocation be present, the immediate vertebra will usually reveal the seat and extent of the displacement by the altered relation of the displaced bone. Should the displacement be but slight, the spinal cord may possibly escape injury, and reduction may be followed by recovery without paralysis.

Fracture of the spine can hardly be mistaken for any other type of local injury, as the symptoms are usually unmistakable, and the history of the accident would probably warrant a most justifiable *suspicion* of fracture from its severity, even before the local manifestations were determined.

FRACTURES OF THE RIBS.

Fractures of the ribs occur rarely among the young, as the elasticity of the ribs is great in youth, but are most frequent in elderly people, or in adult life.

They occur as a rule from external injuries applied to the chest wall, as in blows, falls, the passage of wheels over the chest, or from pressure between two opposing forces.

In rare instances fracture of the ribs has occurred from muscular effort, as in attacks of coughing; but in these cases a structural change had probably ensued within the bone, before the fracture occurred.

The ribs may be broken in one of two ways: either by the direct force of the injury, in which case the seat of fracture will correspond probably with the seat of the external contusion, and one or two ribs only will be implicated, the fractured ends being driven *inwards;* or the ribs may be fractured at a point remote from the seat of injury by an indirect force, causing excessive bending of the bones. In these cases the ribs are usually broken at about their middle, and the fractured ends of two or three bones are simultaneously displaced *outwards.*

Fractures of the ribs may be also divided into the complete, and the incomplete. In the former variety, the separation of the fragments is such as to allow of displacement and marked crepitus. In the latter, either the bone itself is imperfectly fractured, or the periosteal coverings still remain intact and prevent any displacement, and often conceal all symptoms of local injury to the bone.

Fractures of the ribs may be unilateral or occasionally bilateral,

in situation; simple, comminuted, or compound, in variety. The middle ribs are the most frequently involved, and the first three ribs are seldom fractured.

Fractures of the ribs may be uncomplicated, or complicated. If complicated, the integument may be lacerated, producing a compound variety of fracture. The bone may be shattered by gun-shot wounds, etc., resulting in the comminuted variety of fracture. The pleura may be involved, producing pleurisy, etc. The lung-tissue may be penetrated, thus inducing pneumo-thorax, pneumonia, pulmonary hemorrhage, emphysema, etc.

The heart and pericardium may become implicated. The intercostal vessels may be wounded, and finally the diaphragm and the abdominal viscera may be injured, provided the lower ribs be involved and greatly displaced.

The proportion of uncomplicated cases of fractured ribs to the total number of recorded cases, is very large,—at least seventy-five per cent. The balance usually recover, however, provided the complication is not of a markedly serious and severe type.

Fractures of the ribs are to be diagnosed from many pulmonary affections, especially if connected with, or created by a severe contusion of the chest wall, or some variety of direct injury. Among the diseases which are liable to be confounded with a fracture of the rib, are pneumo-thorax if traumatic in origin, pleuritic inflammation and emphysema of tissues.

In the following pages will be enumerated the distinctive diagnostic points of each in contrast, with those of fracture of the rib.

In closing the subject of fracture I also append a differential diagnosis between Fracture and Dislocation of bone, as a general *resumé* of the symptoms common to both.

FRACTURE OF THE RIBS.	PLEURITIC INFLAMMATION, (*in the dry stage associated with contusion*).
APPEARANCE OF CHEST.	
The projecting edges of the fragments of the fractured ribs can often be detected, or an irregularity in the course of the rib may result from its displacement, in case no fragments can be discovered.	No projecting fragments can be discovered, or any irregularity in the course of the rib.
The chest wall is often locally depressed in case of fracture.	The chest wall is normal, until effusion into the pleural cavity produces *bulging* of the affected side.
PALPATION.	
Crepitus may often be felt on palpation.	Palpation is negative in its results.
AUSCULTATION.	
Auscultation yields the fine grating noise of crepitation.	Auscultation perceives a harsh *friction* sound, before the fluid separates the inflamed pleural surfaces.
COUGH.	
Cough is absent, if no complication exist.	Cough, *without expectoration*, is usually present.

SYMPTOMS IN COMMON.

Both are associated with localized *pain in the side.*
" " " " abnormal sounds on auscultation.
" " " " diminished expansion of the chest.
" " " " elevation of pulse and temperature.
" " " " local ecchymosis.
" " " " a history of an accident.

FRACTURE OF THE RIBS.	PNEUMO-THORAX, (*of a traumatic origin*).
APPEARANCE OF CHEST.	
The chest wall is often locally depressed at the seat of fracture.	The chest wall is distended, and the intercostal spaces widened from air within the pleural cavity.
OUTLINE OF RIBS.	
The fractured rib can often be felt to be irregular in outline, or the fragments can be felt to overlap each other.	The outline of the ribs is seen and felt to be normal.
DYSPNŒA.	
The dyspnœa present is due only to the pain, and is not excessive.	The dyspnœa is *intense* and is due to compression of the affected lung by atmospheric pressure.
PALPATION.	
A vocal fremitus can be perceived on palpation of the chest when the patient speaks or counts, and crepitus may also be detected.	No vocal fremitus, or crepitus is detected.
PERCUSSION.	
The percussion note is normal over the affected side.	Pure "*tympanitic*" percussion resembling that of the abdomen, will be present.
INSPECTION.	
The expansion of the affected side is limited, but plainly perceptible.	*No expansion* of the affected side occurs on inspiration.
AUSCULTATION.	
Respiratory sounds are heard over the seat of fracture, though they may be feeble.	No respiratory sounds are heard, provided the lung be not punctured, but if so, "*amphoric breathing*" may exist.

SYMPTOMS IN COMMON.

Both are associated with pain.
" " " " dyspnœa.
" " " " history of traumatism.

FRACTURE OF THE RIBS. EMPHYSEMA OF TISSUES.

Appearance of the Chest.

The chest wall is often depressed at the immediate seat of fracture.

The tissues over the chest are inflated with air, and the chest has, therefore, a puffy or distended appearance, which is often extensively diffused.

Abnormal Sounds.

A fine, grating crepitus may be perceived during inspiration or expiration, both on palpation and auscultation.

A peculiar "crackling" noise and sensation to the touch may be perceived on pressure over the emphysematous tissues, irrespective of respiratory efforts.

Outline of Ribs.

The outline of the fractured ribs is felt often to be irregular; or the overriding of the fragments may be detected.

The ribs are felt to be normal in their outline and position, if their contour can be detected through the inflated tissues.

Effects on Respiration.

Pain is present in the side, and the breathing is often restricted in consequence.

Pain may not be present to any serious degree, nor need the breathing be, of necessity, restricted.

Duration of the Symptoms.

The symptoms are continued for some days after the accident.

The symptoms *may*, in some cases, rapidly subside.

SYMPTOMS IN COMMON.

Both are associated with abnormal auscultation.
" " " " " palpation of the chest.
" " " " deformity.

FRACTURE IN GENERAL, IN THE VICINITY OF JOINTS.	DISLOCATION.
DEFORMITY.	
The deformity is not *in* the joint, but near it, as is shown by comparison with the opposite side.	The deformity is great, and is located in the joint itself.
It varies in its *seat* and in its *degree*, and is easily removed.	It is stationary, and disappears only after reduction of the dislocation.
The abnormal projections are usually felt to be small and *irregular* in shape.	The abnormal tumor, when perceived, is felt to be large, smooth, and rounded at its edges.
The axis of the limb is not uniform, but varies with changes in the relation of the fragments to each other.	The axis of the limb is abnormal, but is constantly the same and is of uniform direction throughout the whole length of the bone.
MOBILITY OF THE LIMB.	
The mobility of the limb is of an abnormal type.	The movements of the joint are greatly restricted, both in degree and direction.
It is augmented in its degree.	The movements are located in the immediate locality of the normal joint, but not within it.
It is not always located at the region of a joint.	All attempted voluntary movements are normal in direction, but restricted in amount.
All attempted voluntary movements are abnormal.	
CREPITUS.	
Appears at the time of the accident, is easily obtained, and is of a *grating* character.	If present, crepitus is a late symptom; is obtained with difficulty, and is of a *rubbing* character.
PAIN.	
Is seldom severe if the parts are at rest.	Is usually severe even though the parts are at rest.
It continues after reduction.	Is always relieved by reduction.

FRACTURE IN GENERAL, IN THE VICINITY OF JOINTS, (*continued*).	DISLOCATION, (*continued*).
Length of Limb.	
Shortening is often present, but lengthening never.	Shortening and lengthening may both, at times, exist.
Position of Limbs.	
Fractured limbs usually lie close to the median line of the body.	Dislocated limbs usually stand out from the body, and cannot be made to lie parallel to its median line.
Appearance of Joints.	
The bony prominences in the vicinity of joints are unaltered in their relations to each other.	The relations of the bony prominences normal to the joint are unaltered.
Sensibility.	
Numbness of the injured limb is often absent, but if present, is slight in amount.	Numbness is often a prominent symptom ; it is usually present to a greater or less degree.
Ecchymosis.	
Is often extensive, and is located in a dependent part.	Is usually slight and superficial, if present.
Reducibility.	
The deformity is easily reduced, but shows a tendency to return.	The deformity is reduced often with difficulty, but when accomplished, no tendency towards a return is manifest.
No sound is perceived at the moment of reduction.	A distinct *snap* is often perceived at the moment of reduction.

DISEASES OF THE MALE GENITALS.

DISEASES OF THE MALE GENITALS.

THE surgical diseases of the male genitals may be divided into

A. Diseases of the TESTICLE.
B. " " TUNICA VAGINALIS.
C. " " SPERMATIC CORD.
D. " " SCROTUM.
E. " " BLADDER.
F. " " PROSTATE GLAND and URETHRA.
G. " " PENIS.

I shall consider the diseases of the male genitals in this order, enumerating under each of the separate divisions the various surgical conditions liable to exist, and the sources of error in diagnosis which pertain to the various organs under consideration. I shall endeavor in this chapter to elucidate as exhaustively as is compatible with conciseness, those diseases which are most common in a general surgical practice, and shall be content with the enumeration only of such as are infrequent, referring those desirous of more extended information to the various monographs upon the special subjects.

DISEASES OF THE TESTICLE.

The testicles may become *enlarged* from the following named conditions:

1. SIMPLE INFLAMMATORY ORCHITIS which is a frequent sequela of injury, mumps by metastasis, and extension of inflammation down the spermatic cord. It is largely due to an œdematous infiltration of the testicle, but may result in suppuration, and is associated with all the symptoms characteristic of inflammatory processes in general.

2. SPECIFIC DEPOSIT WITHIN THE TESTICLE, or "SYPHILITIC ORCHITIS." This type of disease is a sequela of the acquired variety of syphilis, as a rule. It consists of circumscribed, or infiltrated deposits of gummata. It is a rare affection before the age of puberty, and is most frequently located at the period of its commencement, in the *body* of the testicle. It may, however, subsequently involve the epididymis.

3. CHEESY DEGENERATION OF THE TESTICLE, or "TUBERCULAR ORCHITIS." This variety of degeneration occurs in a tubercular diathesis, and exists in connection with a similar condition of other organs in the large majority of cases. It is essentially a disease of early manhood, and is primarily located in the *globus major* of the epididymis. It is associated, as a rule, with impairment of the general health, and is frequently accompanied by suppuration in its advanced stages, and in some cases by fungoid growth.

4. "MALIGNANT ORCHITIS," or CANCEROUS DEPOSIT IN THE TESTICLE. This variety of disease may occur in all ages. It is a frequent disease after the age of fifty. It is primarily a disease of the *body* of the testicle, but involves the epididymis and the cord in its advanced stages. It is associated with impairment of the general health as the later cachexia is developed. It is chiefly of the encephaloid variety, although scirrhus may occur in this region, and occasionally melanoid cancer may be present.

5. CYSTS OF THE TESTICLE, called also "CYSTIC SARCOMA." This is a rare affection, and consists of compound or proliferous cysts developed within the testicle. They vary usually in size from that of a millet seed to the dimensions of a pigeon's egg, and contain either a transparent, viscid, albuminous fluid, or a blood-stained fluid with coagula. The cysts are usually of an elongated form, and are primarily a disease of the *body* of the testis, although the epididymis may become involved. They are probably produced by an occlusion of the *tubuli*

seminiferi, or the ducts of the *rete testis*. They are sometimes associated with enchondroma.

6. HÆMATOCELE OF THE TESTICLE. This is frequently the result of a blow, as in riding on horseback, and being thrown upon the pommel of the saddle; or of violent muscular efforts, as in attempts to raise heavy weights. It may also occur from direct wounds of the testicle, and during scurvy and purpura.

   It is due to the rupture of a blood-vessel, and the blood is usually effused into the cavity of the tunica vaginalis. The testicle under these circumstances immediately enlarges, and symptoms referable to the escape of blood become manifest.

   Hæmatocele may occur when hydrocele has preceded the exciting cause of hemorrhage. In this way tapping not infrequently creates a complication, although a lancet, if used, is more liable to produce hæmatocele than a trochar.

   The source of hemorrhage in hæmatocele of the testicle may be the spermatic artery, or some of the branches either of the spermatic, or of the artery of the vas deferens. The testicle, as a rule, lies at the posterior portion of the tumor, but as this rule has exceptions, pressure upon the back of the tumor in doubtful cases will yield the peculiar "sickening sensation," usually associated with compression of the testicle, and thus decide its exact location.

7. LIPOMA OF THE TESTICLE. Fatty tumors of the testicle occasionally occur. They are to be diagnosed by their slow and painless growth, by the absence of an exciting cause, by the general health being unimpaired, and by the general characteristics of fatty deposits.

8. FIBROUS TUMORS OF THE TESTICLE. This type of disease is frequently associated with the condition of atrophy of the testicle.

   It consists of a marked increase in the connective tissue of the organ.

It may also accompany cysts of the testicle, or it may occur as an independent process, resulting in a painless and marked enlargement of the organ, as is common in the so-called "chronic enlargement" of the testicle, which possesses no distinctive symptoms.

It is questionable if this state of chronic induration is not, in the majority of cases, a direct sequela to a chronic orchitis, the products of the inflammation having undergone organization into connective tissue, instead of becoming absorbed.

9. ENCHONDROMA OF THE TESTICLE. Cartilaginous tumors of the testicle are seldom unassociated with other textural changes within that organ. Still, in rare cases, the deposit has been localized to so marked a degree as to constitute a separate or principal lesion.

While this type of tumor is often associated with cancer of the testicle, yet it can doubtless be regarded as in itself, non-malignant.

10. BENIGN FUNGUS OF THE TESTICLE, or "HERNIA TESTIS." This term is used to express a condition of the testicle, where a fungus growth protrudes from the testicle and scrotum. The term "*granular swelling*" has been sometimes used to express this condition, but the mode of origin has caused the term "*hernia testis*" to be more universally applied.

This fungus growth consists of a protrusion of the glandular structure of the testicle through the tunica albuginea, the tunica vaginalis, and the adherent scrotum.

It results frequently from suppuration of the testicle and ulceration of its coverings, as a sequela of chronic orchitis. It may, however, occasionally follow an acute suppurative process within the testicle, but these cases are uncommon.

The fungus, on microscopical examination, is found to consist of the tubules of the testicle with intertubular changes, and granulations springing up from those tubules which are nearest to the surface.

The tunica albuginea is thickened around the margin of the opening, through which the fungus

protrudes, the edges of which are everted. The scrotum around the margin of the opening is indurated and thickened, and in some cases is undermined.

11. CHRONIC INFLAMMATORY INDURATION OF THE TESTICLE. This variety of disease, to which the term "chronic orchitis" is applied, is of surgical importance from its tendency to destroy the glandular structure of the testicle.

    It usually follows an attack of simple acute orchitis whose duration has been prolonged by repeated attacks, or by excess in alcohol and venery, or traumatism.

    It results in a gradual enlargement of the testicle without any markedly acute symptoms, and is more closely allied in its history to that of tubercular deposit.

    It differs however from that disease in its primary seat, which is usually within the *body* of the organ, as well as in its general pathological characteristics.

    It is a frequent cause of *benign fungus* of the testicle from ulceration of the tunica albuginea.

    It is to be diagnosed from cancer of the testicle, tubercular orchitis, and hæmatocele of the testis.

The testicle may present also the following conditions which are *not accompanied with an enlargement* of the organ, but which are of surgical interest:

1. ARRESTED DEVELOPMENT OF THE TESTICLE.
2. CONGENITAL MALFORMATIONS OF THE TESTICLE; including
   - Inversion of the testicle.
   - Union of the testicles.
   - Supernumerary testicle.
   - Impervious vas deferens.
3. CONGENITAL ABSENCE OF THE TESTICLES: "*cryptorchidism.*"
4. NEURALGIA OF THE TESTICLE.

5. Atrophy of the Testicle.
6. Incomplete Descent of the Testicle: "*monorchidism.*"
7. Calcareous Deposits in the Testicle.

Many of these affections can with difficulty be mistaken in diagnosis, and will therefore be simply enumerated. In the following pages will be found contrasted, however, those diseases which constitute the principal sources of error in diagnosis.

ACUTE ORCHITIS.	NEURALGIA OF THE TESTIS.
HISTORY.	
Is usually either of traumatic origin, or is associated with a history of venereal disease.	Is a frequent affection in weak and nervous young men, and in masturbators. It also is often associated with varicocele and malarial conditions.
TESTICLE.	
The testicle is swollen, but is not always retracted.	The testicle is retracted during the attack, if severe, but is normal in its size.
PAIN.	
The pain is constant and not paroxysmal.	The pain is paroxysmal in character, and *intense*.
It comes on gradually with the swelling and disappears slowly.	It comes and goes suddenly, without premonition.
GASTRIC SYMPTOMS.	
Nausea and vomiting are infrequent.	Nausea and vomiting are often present.
EFFECT OF PRESSURE.	
Great tenderness on pressure exists, until the swelling or the acute symptoms disappear.	The testicle is painless on pressure during the intervals between the attacks.

SYMPTOMS IN COMMON.

Both are associated with marked *pain* in the testicle.
" may be " " nausea and vomiting.
" " " " tenderness on pressure.

SYPHILITIC ORCHITIS.	TUBERCULAR ORCHITIS.
LOCATION OF ORIGIN.	
Begins in the *body* of the testicle as a primary disease.	Begins in the *globus major* of the epididymis, and involves the testicle secondarily.
AGE AFFECTED.	
May exist at any age; but seldom before puberty.	Occurs in early manhood, as a rule.
EXTENT.	
Is usually a *unilateral* disease.	Is frequently a *bilateral* disease.
TESTICLE.	
The testicle is regular in contour, uniform in its consistence, and harder than normal.	The testicle is marked with hard, knotty nodules, but is soft and elastic between them.
HYDROCELE.	
Hydrocele is occasionally present.	Hydrocele is an infrequent complication.
TERMINATION.	
Tends towards calcareous or fibrous degeneration, or atrophy.	Tends towards cheesy degeneration and suppuration after an interval.
ULCERATION AND FUNGUS.	
Ulceration and fungoid growths are absent.	Ulceration and fungoid growths are frequent in the last stages.
FISTULÆ.	
Fistulæ are seldom formed.	Fistulæ are frequently formed which heal after the gland has been evacuated.
HISTORY.	
A history of syphilis exists, or evidences of it are discovered in the skin or the glands.	A tubercular history is present, and other organs are usually affected.
SEXUAL DESIRE.	
Sexual desire is decreased, but the power of coition is usually slowly affected.	Sexual desire is increased, but the power of coition is usually impaired.

MALIGNANT ORCHITIS.	SYPHILITIC ORCHITIS.
AGE AFFECTED.	
Affects all ages, even children.	Is very rare before puberty.
PREVIOUS HISTORY.	
No previous history of causation exists.	A history of syphilis, or some evidences of it, is usually present.
SEAT OF ORIGIN.	
Begins in the *body* of the testicle, but grows rapidly.	Begins in the *body* of the testicle, but grows *slowly* and painlessly.
CHARACTERISTICS OF THE TUMOR.	
The tumor ulcerates, and tends to form a fungoid growth.	The tumor never ulcerates, nor tends to form fungoid excrescences.
The tumor often invades the cord.	The tumor seldom invades the cord.
The tumor is not of uniform consistence.	The tumor is uniform in consistence.
PAIN.	
The pain is severe and *lancinating* in character during the latter stages.	Pain is seldom present. A sense of weight only exists.
INTEGUMENT.	
The skin is always involved in its advanced stages.	The skin is seldom involved.
FLUCTUATION.	
Fluctuation is often detected over localized spots in the testicle.	Fluctuation is absent.
EFFECT OF CASTRATION.	
The tumor returns, as a rule, after castration.	The tumor, if removed, never exhibits a tendency to return.

CYSTS OF TESTIS.	HYDROCELE.
FREQUENCY.	
Is a rare malady.	Is an extremely frequent disease.
SIZE OF TESTICLE.	
The testicle may be either enlarged or diminished in size.	The size of the scrotum is always increased; but the testicle is unaffected as to its size.
TUMOR.	
The tumor consists of a localized swelling which may be situated in different parts of the testicle.	The tumor begins from below and extends upwards.
TRANSLUCENCY.	
The tumor is not translucent.	The tumor is translucent on placing a lighted candle behind it.
FLUCTUATION.	
The fluctuation, if perceived, is very indistinct. It may often be absent.	Fluctuation is well marked, and is always detected.
VEINS OF CORD.	
The veins of the cord are enlarged and varicose.	The veins of the cord are normal in their appearance.

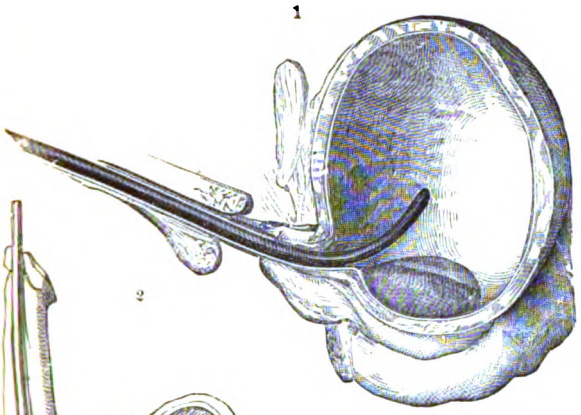
SYMPTOMS IN COMMON.

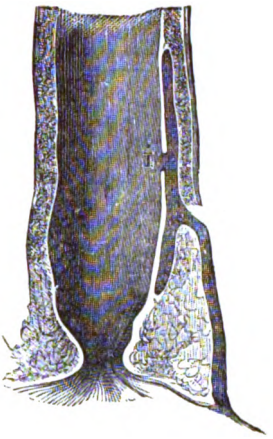
Both are associated with slow development.
" " " " absence of pain.
" " " " oval or globular form.
" " " " smoothness of the surface.
" " " " elasticity.
" " " " fluctuation.

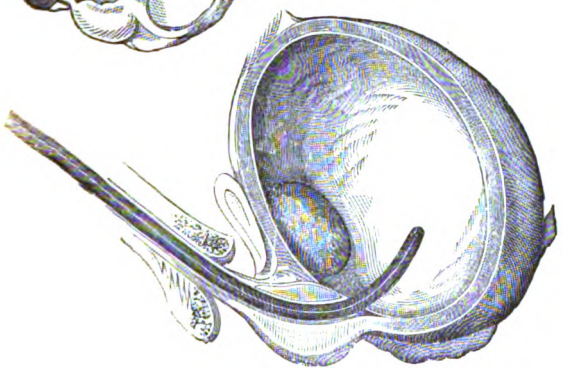
BENIGN FUNGUS OF TESTICLE (HERNIA TESTIS).	CANCER OF TESTICLE, WITH FUNGUS.
DEFINITION.	
Is a protrusion of the tubular structure of the gland through the coverings of the testicle and scrotum.	Is a rapidly increasing growth, possessing no resemblance to the glandular structure of the testicle.
APPEARANCE OF TUMOR.	
The tumor has a *neck* which is markedly constricted.	The constriction at the neck is not well marked.
SURFACE OF TUMOR.	
The surface is granular, but is firm in its texture.	The surface is *friable* in its texture.
EFFECTS OF PRESSURE.	
The tumor is painless to the touch, but the testicle is normally affected by pressure.	The testicle fails to yield the normal "sickening sensation" on pressure.
PAIN.	
The pain is severe until protrusion occurs, when it ceases.	The pain is of a violent and lancinating character.
CHARACTER OF THE DISCHARGE.	
The discharge from the fungus often contains spermatozoa.	Hemorrhage is frequent from its surface, especially when handled; and the discharge is profuse and fœtid.
LOCATION.	
The disease is always unilateral.	The disease *may* be bilateral.
COMPLICATIONS.	
The skin, spermatic cord, and neighboring glands are usually normal.	The integument, spermatic cord, and neighboring glands are usually involved.
GENERAL HEALTH.	
The general health may be good.	A marked cachexia exists.

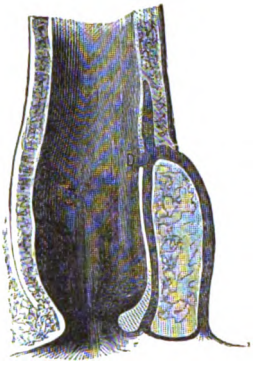
ORCHITIS.	EPIDIDYMITIS.
Frequency.	
Is a very rare affection.	Is extremely common.
History.	
Is produced by mumps, cold, gout, traumatism, etc., etc.	Is almost invariably associated with urethral disease or irritation.
Pain.	
The pain is excruciatingly severe, even in cases of moderate enlargement, and is not relieved by position.	Pain is usually of moderate severity, except in extreme enlargement, and is relieved by position.
Shape of Tumor.	
Is usually associated with an *oval* tumor.	The shape is often modified by scrotal œdema.
Effects upon Testicle.	
The testicle is extremely hard and very sensitive to pressure.	The *body* of the testicle is, as a rule, normal. If complicated, it is less sensitive than orchitis.
The epididymis is not distinguishable from the rest of the tumor.	The epididymis always becomes distinguishable when the disease is in its decline, although often obscurely so at its height.
Hydrocele.	
Hydrocele is rare as a complication.	Hydrocele is always present in acute cases.
Course of Disease.	
The disease is slow in its progress.	The disease is usually rapid in its progress.
Constitutional Symptoms.	
The constitutional symptoms are often marked.	The constitutional symptoms are absent, or unimportant.

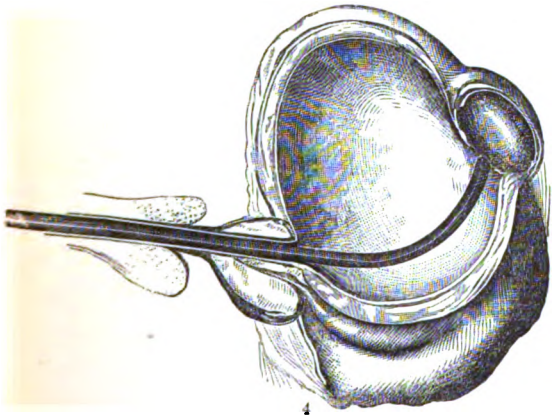
PLATE XVI.

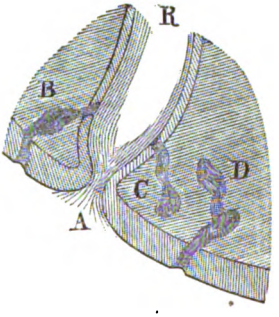












1. Calculus behind prostate. 2. Enlarged middle lobe of prostate. 3. Calculus behind pubes. 4. Calculus encysted in walls of bladder. 5. Fistula of rectum with a diverticulum beneath rectal walls. 6. Rectal fistula with double openings. 7. Diagram of different varieties of rectal fistula. (B. C. D.)

ORCHITIS (*continued*).	EPIDIDYMITIS (*continued*).
METHODS OF TERMINATION.	
Resolution, abscess, gangrene, atrophy, or chronic induration may occur.	Resolution with chronic thickening of epididymis usually takes place.
EFFECTS ON FUNCTION.	
Impotence may result if both sides have suffered destruction of tissue.	Temporary sterility may occur, but never impotence.

("Genito-Urinary Diseases and Syphilis," *Van Buren and Keyes.*)

TABLE FOR THE DIAGNOSIS OF DISEASES OF TESTICLE.

SYPHILITIC TESTIS.	TUBERCULAR TESTIS.	MALIGNANT TESTIS.	SARCOMA OF TESTIS.
	AGE AFFECTED.		
Rare before puberty.	Early manhood and youth.	All ages are affected, but youth most frequently.	Early manhood.
	HISTORY.		
Syphilitic.	Scrofulous.	No cause or previous history of disease exists.	No history; cause unknown.
	SEAT OF ORIGIN.		
Begins in the *body* of the testicle.	Begins in the globus major of the epididymis.	Begins in the *body* of the testicle.	Begins in the *body* of testicle.
	GENERAL HEALTH.		
Unaffected.	Usually impaired.	Impaired in the last stages.	Unimpaired till late in disease, if ever affected.
	PROGRESS OF DEVELOPMENT.		
Slow and indolent.	Slow in growth.	Rapid in its growth.	Very slow, but often becoming suddenly rapid.
Skin rarely involved.	Skin becomes involved before suppuration.	Skin involved in its late stages.	Skin unaffected.
Suppuration rare.	Suppuration present.	Ulceration and fungus growth frequent.	No suppuration or fungus growth.
Hydrocele common.	Hydrocele infrequent.	Hydrocele infrequent.	Hydrocele rare.
	PAIN IN TESTICLE.		
No pain present; a sense of weight only is perceived.	Absent until suppuration commences.	A severe and lancinating pain is always present in the last stages.	No pain.
	SURFACE OF THE TUMOR.		
Irregular at first, but ultimately smooth.	Nodular and knotty throughout.	Smooth but uneven.	Slightly uneven.
	CONSISTENCE OF TUMOR.		
Hard and stony.	Hard and resistant.	Soft and fluctuant in spots.	Fluctuant in spots.
	EPIDIDYMIS.		
Seldom affected.	Begins in it, and it is affected throughout the disease.	Extends to it in the last stages.	Is seldom involved.

SYPHILITIC TESTIS.	TUBERCULAR TESTIS.	MALIGNANT TESTIS.	SARCOMA OF TESTIS.
	(*Continued.*)		
	SCROTAL VEINS.		
Unchanged.	Normal.	Enlarged and varicose from pressure of inguinal glands.	Normal.
	SIZE OF TUMOR.		
Comparatively *small.*	Never very large.	May be immense.	May be very large.
	EFFECT OF PRESSURE.		
No pain or any sensation on pressure.	No pain on pressure.	Pain aggravated by handling tumor.	No pain; but squeezing the testicle produces *faintness.*
	NUMBER OF TESTICLES AFFECTED.		
Both testicles often consecutively attacked.	Both testicles often attacked in succession.	Only one testicle is, as a rule, affected.	One testicle only is involved.
	FUNGUS GROWTH.		
Is *very* rare.	Is *very common;* and is pale, soft, and bleeds easily. Pus thin. Sinuses exist leading into testicle.	Is *constant* in the advanced stages. Fungus bleeds profusely. Fungus discharge is bad-smelling and ichorous.	*No fungus* ever exists.
	Fungus grows *slowly.*	Fungus grows rapidly.	
	Fungus is *painless.*	Fungus is very painful.	
	DURATION.		
Several years.	Several years.	Average is about two years.	Indefinite duration.
	PROGNOSIS.		
Recovery, if well treated.	Radical cure rare.	Bad prognosis. Kills by hemorrhage, cachexia or return after castration.	Good prognosis if removed. If left, may become cancer.
	TERMINATION.		
Calcareous degeneration. Fibrous degeneration. Atrophy.	Suppuration, formation of fistulæ, and evacuation of the testicle.	Ulceration and fungoid growth.	Cancerous degeneration, or stationary condition.

HÆMATOCELE.	HYDROCELE.
Rapidity of Development.	
The tumor develops rapidly if of traumatic origin, but slowly if spontaneous in character.	The tumor develops slowly.
History.	
A history of traumatism is frequently present.	No history of injury exists.
Fluctuation.	
Fluctuation is detected at first, but soon disappears, as coagulation of the blood renders the tumor *hard* and non-fluctuant.	Fluctuation is well marked at all times and over all portions of the tumor.
Shape of Tumor.	
The tumor is pyriform in shape.	The tumor is usually *ovoid* in shape.
Effect of Transmitted Light.	
The tumor is opaque, as shown by a lighted candle placed behind it.	The tumor is translucent, save at the posterior portion, where the testicle is usually present.
Appearance of Skin.	
The skin is usually discolored.	The skin is normal in color.
Constitutional Symptoms.	
Pallor, prostration, and general evidences of loss of blood exist.	No symptoms referable to hemorrhage are detected.
Weight of Tumor.	
The tumor is heavy in weight.	The tumor is light in weight.
Spermatic Cord.	
The cord is free and unaffected in the majority of cases.	The spermatic cord is sometimes involved.

DISEASES OF THE TUNICA VAGINALIS AND OF THE SPERMATIC CORD.

The tunica vaginalis, or the serous covering of the testicle, may contain within its normal cavity either effused blood, constituting hæmatocele, or an excess of its natural secretion, constituting the disease termed hydrocele.

The first of these has already been considered under diseases of the testicle, although it may properly be also classified as a disease of the tunica vaginalis. The second condition, viz.: that of *hydrocele*, may be of several distinct anatomical varieties.

Hydrocele may be classified into

1. SIMPLE HYDROCELE. This condition is the direct result of inflammatory processes occurring in the tunica vaginalis and the sub-serous cellular investment. The inflammatory process is, in the majority of cases, essentially of the chronic variety. The testicle is found enclosed, or rather displaced by the distended sac, which contains an amber-colored fluid, and is usually located at the posterior portion of the scrotal tumor, rather below its centre.

   This position of the testicle, although present in the large majority of cases, is not always insured. Old adhesions in the serous coverings of the testicle from previous inflammation often retain that organ in some particular locality, and the fluid is thus forced to accumulate in some special direction.

   It is thus probably that the so-called "MULTILOCULAR HYDROCELE" is produced, in which distinct cysts, having often no communication with each other, are detected.

   Hydrocele is without doubt the most common disease of the testicle or its coverings. It affects all ages and all ranks of life. It is most common, however, in infancy and in middle life, and occurs in warm climates more frequently than in cold regions.

   It is generally unilateral, and the left side is most frequently affected.

   The exciting causes of the disease seem to include

anything which will disturb the nicely adjusted balance between the functions of secretion and absorption. Thus, all causes exciting an abnormal determination of blood to the part, or impeding the free venous return, may result in this condition from interference with the circulation within the gland or its coverings.

The dependent position of the left testicle, and the absence of a *direct* venous return on the left side, afford an explanation of its frequency on that side of the scrotum, although the pressure exerted by the sigmoid flexure of the colon upon the spermatic veins, is also advanced as a possible exciting cause.

Hydrocele is usually developed after a violent strain, or great fatigue, or after a slight blow upon the gland which was considered, at the time, as trivial. It may also accompany hydræmia, and may result from sympathetic connection with chronic diseases of the urethra or bladder.

If hydrocele is accompanied by an enlargement of the testicle, the condition is often distinguished by the term "HYDRO-SARCOCELE."

2. CONGENITAL HYDROCELE. This condition occurs from an imperfect closure of the canal between the cavity of the peritoneum and that of the tunica vaginalis after the testicle has descended. The opening remaining is usually small in size, and the fluid which accumulates seems to be due to gravity of the peritoneal effusion.

A rare form of disease, resembling a congenital hydrocele, accompanies a late transition of the testicle when no hernial protrusion simultaneously occurs.

Congenital hydrocele is to be confounded with a reducible intestinal hernia, and with ordinary hydrocele.

3. ENCYSTED HYDROCELE OF THE TESTICLE. In this form of hydrocele, fluid is effused into an adventitious cyst, or cysts, distinct from the cavity of the tunica vaginalis.

They may be developed in one of two situations:

either at the epididymis beneath the visceral layer of the tunica vaginalis, or beneath that portion of the tunica vaginalis covering the *body* of the testicle.

The first is by far the more common, the latter being very rare.

The cysts of the epididymis often become pedunculated, but if so, seldom exceed the size of a pea. They usually contain a small amount of fluid, and are *hard* and semi-transparent. They are quite common after the age of forty.

When "encysted hydrocele of the epididymis" attains, however, a large size, without undergoing pedunculation, the testicle is usually displaced to the *bottom* of the sac; rarely, if ever, to its posterior portion. The tumor is smaller than an ordinary hydrocele, and seldom exceeds four ounces in contents, although the size may, in rare instances, equal that of a *large* hydrocele. These cysts are frequently multiple, and their contents are either straw-colored and albuminous; or they may be thick, turbid, and filled with coagula. When the body of the testicle becomes the seat of this disease, the term "*encysted hydrocele of the tunica vaginalis*" is applied, in contradistinction to simple multilocular cysts, due to adhesions within the cavity of the serous investment of the testis.

They enclose a milky fluid, and often contain spermatozoa, probably introduced by a rupture of the tubules of the testicle from over-distension.

Encysted hydrocele, in general, is characterized by an imperceptible origin, by a slow and painless growth, and by a stationary condition, after attaining a moderate size, which often remains for years producing no inconvenience or pain.

It is to be confounded only with localized hydrocele from adhesions, but the aspirator will usually decide this question by the character of the fluid contents of the tumor.

4. DIFFUSE HYDROCELE OF THE SPERMATIC CORD. This affection is described by *Pott*, under the denomination of HYDROCELE OF THE CELLS of the TUNICA COMMUNIS.

The disease partakes largely of the character of an ordinary œdema diffused throughout the loose connective-tissue of the spermatic vessels, and of the cord, and is enclosed in a layer of compressed tissue, invested by the musculo-aponeurotic structure of the cremaster muscle.

The base of the tumor corresponds to that point where the spermatic vessels join the testicle, and is cut off, at this point, by a dense septum from communication with the tunica vaginalis. It frequently extends along the cord, and may, in rare cases, enter the abdomen. The tumor is smooth, uniform, and nearly cylindrical in shape.

It is a comparatively rare disease, and is produced by obstructed venous return, as exists in case of local pressure from enlarged inguinal glands etc., etc.

It is to be diagnosed from omental hernia, and from encysted hydrocele of the cord.

5. Encysted Hydrocele of the Spermatic Cord. *This* condition is the result of the formation of a distinct cyst, or cysts, within the loose cellular or connective tissue of the spermatic cord. It is usually oval in form, seldom if ever exceeds the size of a hen's egg, and is usually much smaller.

It is situated in one of four locations: either just above the testicle, at the external ring, in the middle portion of the cord, or in the inguinal canal. It is usually a solitary cyst, but in some cases multiple cysts are formed.

It is due, probably, to a *partial* or *imperfect obliteration* of the peritoneal prolongation which accompanies the testicle in its descent into the scrotum, resulting in an isolated sac, or a succession of pouches being left, which becomes distended with serous fluid.

It is of gradual and slow development, and may possess obscure and indistinct fluctuation.

It can be handled without pain, and is often more or less transparent. It is quite freely movable in the longitudinal direction of the spermatic cord.

It is frequent in infants, but may exist at all stages in life.

It is to be diagnosed from encysted hydrocele of the testicle, if close to the gland, by its mobility and its separation from the testicle when drawn upwards, and from the character of its fluid contents.

When in the inguinal canal it may be mistaken for a hernia.

6. VARICOCELE OF THE SPERMATIC CORD AND TESTICLE. The term "VARICOCELE" is used to designate a varicose condition of the spermatic veins within the scrotum, while the term CIRSOCELE is used to denote a varicose condition of the veins of the cord and testicle. The two terms are, however, often used synonymously to express any abnormally varicose condition of the spermatic veins independent of the location affected.

In this disease, the venous coats are thickened so as to resemble arteries in their structure, and their course is rendered tortuous and irregular. The calibre of the veins is increased by dilatation of their coats, and the apparent number of the veins is largely increased by the distension of venous capillaries.

The disease is most frequent upon the left side, the proportion being nearly twenty to one.

The causes of this excessive frequency upon the left side have been thus explained:

1st. The left testicle hangs lower in the scrotum, and thus the veins of the left side support a heavier column of blood.

2d. The spermatic veins of the left side are pressed upon by the sigmoid flexure of the colon when distended.

3d. The spermatic vein of the left side joins the renal vein at a right angle to the current of blood, thus impeding the rapid return of blood from the left testicle.

4th. The left spermatic vein is by some authorities stated to be poorly supplied with valves; but the

anatomical accuracy of the statement is questionable.

Varicocele, as a disease, may result from

A. Causes which *impair* the *general vigor* of the parts.

Under this head may be included

1. Masturbation.
2. Abuse of venery.
3. Chronic orchitis, or repeated attacks of acute orchitis.
4. Lack of proper support from a relaxed scrotum.

B. Causes producing varicocele from *pressure*.

Under this head may be included

1. Abdominal tumors.
2. Enlarged lumbar or inguinal glands.
3. Hernia.
4. Trusses, or belts worn around the waist.
5. Accumulation of fat in the omentum and mesentery.

C. Causes producing varicocele by *muscular effort*. This class of causes may include

1. Prolonged riding on horseback.
2. " rowing.
3. " exercise, in running, waltzing, etc.
4. Excessive and violent muscular efforts.
5. Whooping-cough.

Varicocele occurs most frequently at the time of puberty.

If due to mechanical pressure, it is most frequent in those advanced in life. It is a very common affection, and is indicated by a tumor possessing the appearance and feel of a "bag of worms," associated with a sense of weight and local distress, which increases as night approaches, from the relaxation of the scrotum.

A sense of immediate relief is present after coition, but a severe exacerbation of the symptoms follows during the succeeding twenty-four hours.

Varicocele is to be diagnosed from scrotal hernia, with which it has many points in common.

7. LIPOMA OF THE SPERMATIC CORD. Fatty tumors usually

form in front of the spermatic vessels, as a loose and movable tumor, having a soft, doughy feel, and a lobular appearance. They may be mistaken for a hernia of omentum. They possess no distinctive symptoms, and are a source of little, if any, inconvenience.

8. SPASM OF THE CREMASTER MUSCLE, causing RETRACTION OF THE TESTICLE. This occurs in some diseases of the kidney, in the passage of a renal calculus, and in affections of the prostate gland. In all cases it is the direct result of nervous irritation transmitted from other parts. It may be associated in some instances with a local injury to the groin, and may occur when the testicle or epididymis becomes sympathetically inflamed, from an existing urethral lesion. It is of diagnostic value as confirmatory evidence only when the history of the exciting disease is obscure.

HYDROCELE.	SCROTAL HERNIA.
DEVELOPMENT OF TUMOR.	
The tumor develops slowly.	The tumor develops suddenly, in the majority of cases.
HISTORY OF TUMOR.	
The tumor appeared first at the bottom of the scrotum, without cause.	The tumor developed from above downwards, after a strain, injury, etc.
DENSITY OF TUMOR.	
The tumor is very hard and *elastic.*	The tumor may be hard or doughy, but is never *elastic.*
EFFECT OF LIGHT.	
The tumor is *translucent.*	The tumor is *opaque.*
INGUINAL CANAL.	
The inguinal canal is empty.	The inguinal canal is filled.
SPERMATIC CORD.	
The spermatic cord is easily felt.	The spermatic cord is concealed.
PERCUSSION.	
The percussion note over the tumor is *flat.*	The percussion note over the tumor is usually *resonant.*
FLUCTUATION.	
Fluctuation is apparent.	Fluctuation is absent.
COUGH IMPULSE.	
No impulse, on coughing, is perceived in the tumor.	A cough impulse is perceptible, as a rule, within the tumor.
AUSCULTATION.	
No gurgling is heard within the tumor.	Gurgling within the tumor is often detected.
CONSTIPATION.	
The function of the alimentary canal is unimpaired.	Constipation may result from the displacement of the intestine.
REDUCIBILITY.	
The tumor cannot be reduced.	Reduction is possible.

VARICOCELE.	SCROTAL HERNIA.
PALPATION.	
The tumor is knotty and irregular and feels like "a bag of worms."	The tumor is usually smooth on its surface and regular in its outline.
COLOR OF INTEGUMENT.	
A bluish tint is usually present.	The integument is normal in color.
LOCATION.	
Is most frequent on the left side.	May exist on either side.
EFFECT OF HEAT.	
Tumor increases on the application of heat.	The effects of heat upon the tumor are negative.
DEVELOPMENT.	
Gradual.	Sudden.
PERCUSSION.	
A dull percussion note exists over the tumor.	Resonant percussion usually exists.
FLUCTUATION.	
May exist if the vessels be very large.	Never exists.
SPERMATIC CORD.	
Not affected.	Concealed or displaced.
INGUINAL CANAL.	
Uninvolved.	Usually filled.
COUGH IMPULSE.	
Absent.	Usually detected.
REDUCTION.	
Reduces often spontaneously by any position favoring increased venous return.	Reduction is usually accomplished by taxis alone.

VARICOCELE (*continued*).	SCROTAL HERNIA (*continued*).
RETURN OF TUMOR.	
The tumor returns when the patient stands up, in spite of pressure at the ring.	The tumor, if once reduced, can be prevented from a return by pressure at the external ring.
SENSATION IN SCROTUM.	
A sense of weight, and of constant dragging in the scrotum, exists.	There is a sense of distension only, unless inflammation or strangulation exist.

HYDROCELE, ENCYSTED.	CYSTS OF TESTIS.
LOCATION.	
Are most commonly located at the epididymis, but may rarely affect the body of the testicle.	Are most commonly situated in the body of the testicle.
PEDICLE.	
The cysts are often pedunculated.	The tumor is rarely pedunculated.
NUMBER.	
The tumors are frequently multiple.	The tumor is usually single.
SIZE OF TUMOR.	
The tumors are usually quite *small* in size, but may, in rare cases, reach a fluid contents of four ounces.	The tumor is usually of the size of a pigeon's egg when fully developed, and seldom exceeds it.
DEVELOPMENT.	
The tumors grow slowly and painlessly, as a rule, and are often stationary in size for years.	The tumor grows slowly, but is often associated with enchondromatous deposits.
CONTENTS.	
The tumor, if located on the body of the testicle, usually contains spermatozoa, but if on the epididymis an albuminous fluid and occasional coagula are withdrawn on aspiration.	The tumor seldom if ever contains spermatozoa. An albuminous fluid and coagula are however frequently present.
FREQUENCY.	
These tumors are not uncommon after the age of forty years.	Is a rare affection.

HYDROCELE.	CONGENITAL HERNIA.
AGE AFFECTED.	
May affect any age; and, if in adults, is not necessarily associated with a history of a previous attack.	Is usually a disease of infant life; but if once present, subsequent attacks in adult life may occur.
FLUCTUATION.	
The tumor is markedly fluctuant in all of its localities.	The tumor is usually fluctuant at its *upper* portion since the peritoneal effusion gravitates.
TRANSLUCENCY.	
The tumor is *always* translucent.	The tumor *may* be translucent.
PEDICLE.	
The tumor is not pediculated.	The tumor has a marked pedicle.
SHAPE OF TUMOR.	
The tumor is pyriform.	The tumor is globular.
DEVELOPMENT.	
The tumor always develops *slowly* and gradually.	The tumor *may* be of sudden occurrence, or may show sudden and rapid increase in its size when once developed.
INGUINAL CANAL.	
The inguinal canal is empty.	The inguinal canal is either distended or involved.
REDUCIBILITY.	
The tumor cannot be reduced.	The fluid portion, when reduced by taxis or pressure, leaves a previously concealed testicle, which also reduces with a marked gurgle and occasions a peculiar *sickening sensation* during its passage through the inguinal canal.

HYDROCELE OF THE CORD.	INGUINAL HERNIA.
LIMITS OF TUMOR.	
The tumor is circumscribed.	The tumor is frequently scrotal, and is generally diffused.
PALPATION.	
The tumor is tense.	The tumor is soft, as a rule.
REDUCIBILITY.	
The tumor is usually irreducible, but if not so no gurgle is present on its reduction.	The tumor reduces with a gurgle.
TRANSLUCENCY.	
The tumor is often translucent.	The tumor is opaque.
FLUCTUATION.	
The tumor is fluctuant.	The tumor does not fluctuate.
PERCUSSION.	
The percussion note is dull over the tumor.	The percussion note is resonant over the tumor, as a rule.
BOWEL.	
No intestinal embarrassment exists.	Intestinal embarrassment is often present.
IMPULSE FROM TESTICLE.	
The testicle, if moved, transmits an impulse to the tumor.	Movements of the testicle have no effect upon the tumor.
COUGH IMPULSE.	
Impulse on coughing is absent.	An impulse on coughing is frequently felt in the tumor.
AUSCULTATION.	
No gurgling is detected.	Gurgling is often heard in the tumor.
RETURN AFTER REDUCTION.	
The tumor returns after reduction irrespective of position.	The tumor remains reduced if the dorsal position is maintained.

HYDROCELE.	HÆMATOCELE.
Rapidity of Development.	
The tumor develops slowly.	The tumor develops rapidly if of traumatic origin, but slowly if spontaneous in character.
History.	
No history of injury exists.	A history of traumatism is frequently present.
Fluctuation.	
Fluctuation is well marked at all times and over all portions of the tumor.	Fluctuation is detected at first, but soon disappears, as coagulation of the blood renders the tumor *hard* and non-fluctuant.
Shape of Tumor.	
The tumor is usually *ovoid* in shape.	The tumor is pyriform in *shape*.
Effect of Transmitted Light.	
The tumor is translucent, save at the posterior portion, where the testicle is usually present.	The tumor is opaque, as shown by a lighted candle placed behind it.
Appearance of Skin.	
The skin is normal in color.	The skin is usually discolored.
Constitutional Symptoms.	
No symptoms referable to hemorrhage are detected.	Pallor, prostration, and general evidences of loss of blood exist.
Weight of Tumor.	
The tumor is light in weight.	The tumor is heavy in weight.
Spermatic Cord.	
The spermatic cord is sometimes involved.	The cord is free and unaffected in the majority of cases.

DISEASES OF THE BLADDER.

The diseases and the surgical conditions which may affect the bladder may be thus enumerated:

A. MALFORMATIONS OF THE BLADDER, under which head may be included

1. DEFICIENCY OF THE BLADDER, in which the ureters open directly into the urethra, or, as in some reported cases, the ureters may enter the rectum, and thus discharge the renal excretion.

   In the female sex a few cases have been reported where the ureters communicated directly with the vagina.

2. MULTIPLICITY OF BLADDERS. Two well-known reported cases are on record illustrating this malformation.

   In one, that of Blasius, two well-defined sacs existed, into each of which one ureter emptied; in the other, that of Molinetti, five bladders, five kidneys, and six ureters, are said to have existed in one woman.

   It is probable that many cases of sacculated bladder from long-standing disease may have been mistaken for this deformity.

3. EXTROVERSION OF THE BLADDER. This condition is not one of extreme rarity. It is often associated with absence of the pubes, and is due to a congenital absence of the anterior wall of the bladder.

   A protrusion of its posterior surface, which is red in appearance, is caused by the pressure of the abdominal viscera upon it, and appears as a small vascular flattened tumor.

   The extroverted portion usually reveals the openings of the ureters near its centre, and a small rudimentary penis in the male is apparent at its lower margin. In many cases a small pouch, covered with hair, exists, either on the side of, or below the tumor, which, in the male, contains the testicles,

and, in both sexes, often a hernial protrusion of the bowel.

The tumor is extremely sensitive to the touch, often bleeds on slight irritation, and is continually moistened with the urine, which escapes from the open ureters.

This escape of urine not only produces a urinous odor to the patient, but also results in excoriation of the neighboring parts.

B. DISEASES ASSOCIATED WITH STRUCTURAL CHANGES WITHIN THE BLADDER, under which head may be included

1. INFLAMMATORY CONDITIONS OF THE BLADDER:
   - Acute Cystitis.
   - Chronic "
   - Ulceration.
   - Suppuration of the vesical walls.
   - Gangrene.

2. HYPERTROPHY OF THE VESICAL WALLS, associated often with sacculation of the bladder, and resulting from *obstructed* outlet.

3. TUMORS OF THE BLADDER:
   - Fibrous
     - Warty.
     - Polypoid.
   - Villous.
   - Epithelioma.
   - Malignant.

4. BAR AT THE NECK OF THE BLADDER. This occurs chiefly in elderly subjects, and may be due to prostatic enlargement, or may be independent of it.

5. HERNIA OF THE BLADDER: "Cystocele." Is a rare condition, and occurs as an inguinal hernia in the male, and as a femoral or vaginal hernia in the female.

6. INVERSION OF THE BLADDER. This condition occurs rarely, and usually affects children, especially those of the female sex. The bladder is seen to protrude through the urethra.

7. RUPTURE OF THE BLADDER.—The bladder, like all hollow organs, as the heart, uterus, stomach, and in-

testine, is liable to rupture either from over-distention, external violence, or secondary ulceration. It is doubtful, however, if rupture of the bladder from simple over-distention ever occurs, without some degeneration or lack of tone in the vesical walls, unless associated either directly or indirectly with some form of external violence.

Sudden spasm of the abdominal muscles upon an extremely distended bladder might be justly regarded as a complicating accident, greatly assisting in its rupture, as its results differ but little in reality from those of a blow or kick.

Retention of urine, unless due to organic stricture of the urethra, never occurs in a healthy bladder to such an extent as to give cause for apprehending rupture of the organ, provided no external violence occurs simultaneously with its full distention. When excessive accumulation of urine, however, occurs in a bladder long affected with paralysis, enlarged prostate, cystitis as the result of stricture, or other diseases liable to cause weakening or degeneration of the vesical walls, it often requires no external violence to produce a rupture. Thus a sudden slip, turning in bed, violent attacks of sneezing, vomiting, straining at stool or during an attempt at micturition, may, in this condition, produce the most disastrous consequences.

Extreme external violence, however, is the direct cause of the large majority of cases in which this accident occurs. Sudden falls, with a highly distended bladder, from an elevation; falling over some sharp, projecting edge; severe blows or kicks in the abdomen; direct puncture of bladder by a ball, knife, or other missile, are among the numerous accidents included under this head.

SYMPTOMS.—The symptoms occasioned by rupture of the bladder depend greatly on the seat and amount of laceration; also on the presence or absence of complicating hemorrhage from injury of some large vessel.

In the majority of cases, the first sensation experienced is that of laceration of some internal

organ, usually felt in the region of the symphysis; and this accident is occasionally accompanied by an audible sound denoting rupture.

Immediately, as a rule, the sufferer sinks, unable to move; the most intense pain exists, with inability to micturate; occasionally fainting occurs; and, in cases associated with hemorrhage, symptoms of collapse rapidly appear. In some instances, however, the patient has been able to walk for some distance before taking to bed or calling medical assistance. The face becomes pale, the pulse small and fluttering, the respiration hurried and difficult, the skin cold, and covered with a profuse clammy perspiration.

An intense desire usually exists to micturate, with inability to pass a drop through the urethra; and subsequent symptoms of peritonitis rapidly follow. The temperature becomes elevated, the face anxious, the legs are drawn up and flexed at thigh and knee with dorsal decubitus; and tympanites, excessive pain, and tenderness in the abdomen appear. Delirium and hiccough rapidly follow, and mark the approach of death.

There are, as far as I know, only nine reported cases of recovery from an injury of this character.

Death usually supervenes within two to eight days from the date of rupture, resulting from general peritonitis, though cases have existed where a month has intervened between the accident and the fatal termination.

It is, therefore, exceedingly important, in case suspicion of rupture of the bladder is excited, that an immediate diagnosis be fully made. This can generally be done by injecting the bladder with a saline solution to the extent of about a pint, and immediately exploring the cavity of the bladder with instruments, to ascertain if the fluid is retained within its cavity, or whether it has escaped through any existing laceration.

Should it be found to have escaped into the peritoneal cavity, no harm can have been done, as the extravasated urine will only have been diluted with

a non-irritating solution, and a positive diagnosis can be made.

It has been suggested, and strongly advised, as a means of preventing fatal results, that an immediate section through the abdomen be now made over the region of the bladder, exposing the rent, and that thorough washing of the peritoneal cavity be at once performed, the rent being at the same time pared and closed by small silk sutures, care being taken that these sutures do not pierce the mucous membrane of the bladder (in which case they might act subsequently as nuclei for stone), and the external wound closed in the ordinary manner after operations within the peritoneal cavity.

8. STONE IN THE BLADDER. Most of the calculi found within the cavity of the bladder possess a central nucleus, which differs in its character from the investing layers. These nuclei may consist either of inspissated mucus, coagulated lymph, blood clots, renal concretions (chiefly those of uric acid), or foreign bodies which have been introduced in the bladder by the patient, or as the result of some form of accident.

ETIOLOGY. The principal causes of the formation of vesical calculi may be thus enumerated:

(1.) *Hereditary* or *acquired gout.* (By tending to form renal calculi, which escape into the bladder, and act as a nucleus for farther deposit of crystalline salts.)

(2.) *Intra-uterine development* of a small calculus. This may be suspected if young children be affected.

(3.) *Special localities of residence.* (Prominently, in this country, in Kentucky, Ohio, Alabama, and Tennessee.)

(4.) *Sex.* (Females are, by far, the least liable to the development of calculi.)

(5.) *Occupations* which necessitate exposure to dampness.

(6.) *Race.* (The negro race seems to be singularly exempt.)

(7.) *Existing disease of the urinary organs*, such as urethral stricture, prostatic hypertrophy, cystitis, chronic diseases of the kidney, etc.

(8.) *Paraplegia.* (By causing retention and decomposition of urine within the bladder.)

(9.) *Rheumatism* is occasionally followed by the formation of vesical calculi.

NUMBER AND VOLUME. Calculi of the bladder vary greatly in their size, and in the number present. Certain forms (chiefly those of uric acid, oxalic acid, cystic and xanthic) are usually of small size; while others reach a size varying in weight from two drachms to several lbs. Kesselring reported, in 1739, one weighing some six lbs.; and, in Deschamp's case, one weighing fifty-one oz. was removed.

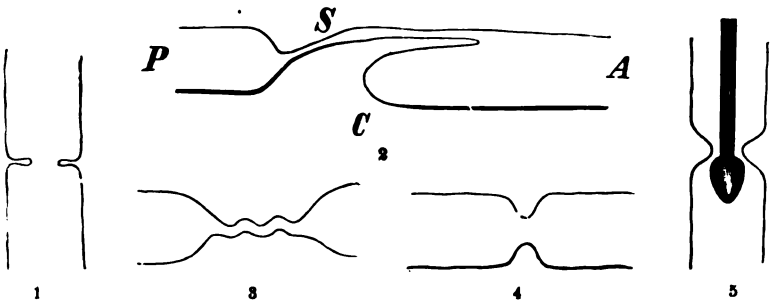
As regards the number present, a *rough* calculus may be, as a rule, considered solitary; while *smoothness* of the surface usually indicates that two or more exist, and by attrition have worn each other smooth. Several cases are on record where over one hundred have been removed at a sitting. Sir Astley Cooper reports 142, Murat 678, Physick (in case of Judge Marshall of U. S. Supreme Court) reports 1000 present, at one time, within the bladder.

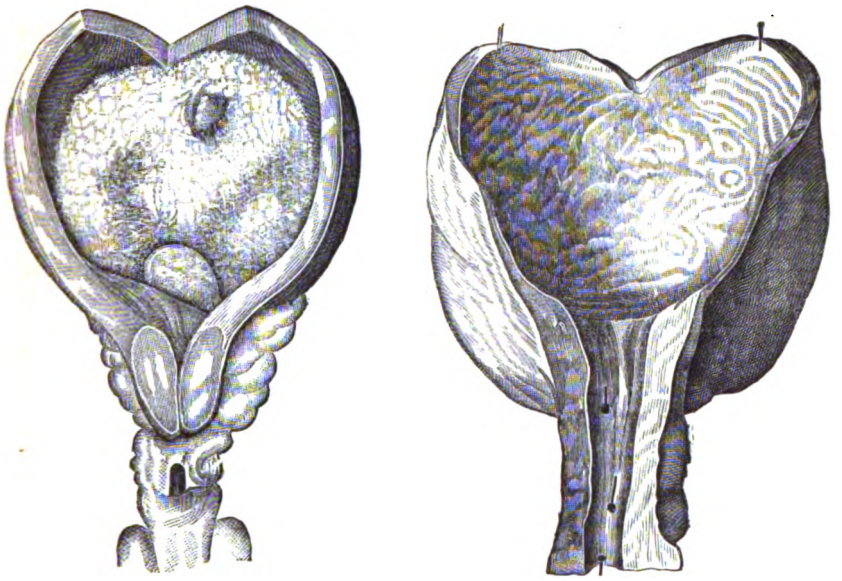
The number present may also be determined, with some degree of accuracy, by the character of the calculus, since the oxalate of lime, or mulberry calculus, as well as the uric acid variety, are seldom multiple, while the phosphatic type are frequently so.

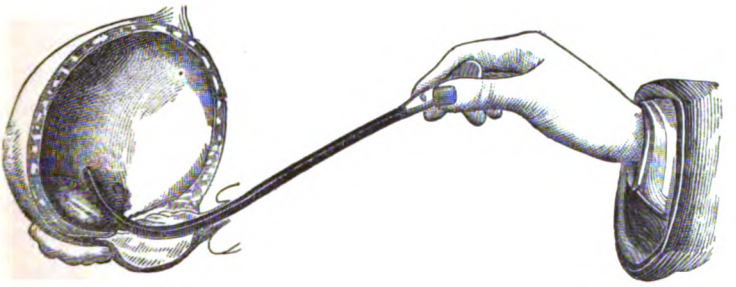
CONSISTENCY AND APPEARANCE. Calculi of the bladder vary from a consistency of wax, as detected in the *cystic* and *fibrous* varieties, to that of granite or marble. The hardest varieties are those formed of *uric acid* and the *oxalate of lime.* In proportion to their density, the danger of the operation for *crushing* is relatively modified, since the hard calculi break into sharp fragments, which are liable to excite severe inflammation of the bladder, if not completely removed at the first sitting.

The *color* of calculi is often of value in deciding as to its chemical formation. As a rule, the following statement will be found correct:

PLATE XVII.







1. Annular stricture of urethra. 2. S, stricture; A, urethra in front; P, urethra behind; C, diverticulum or pouch formed by improper use of instruments. 3. Tortuous stricture. 4. Indurated annular stricture. 5. Bulbous bougie passing a stricture. 6. Medullary tumor of bladder. 7. Hypertrophy of walls of bladder. 8. Sounding for stone in the bladder.

Cystic or *fibrinous* calculi are yellowish.
Phosphatic calculi are whitish or gray.
Oxalic calculi are dark brown or black.
Uric acid calculi are red or brown.

SHAPE OF CALCULI. The variations in form of calculi include the oval, spherical, pyriform, conical, cubic, triangular, polygonal, disc-shaped, semilunar, heart-shaped, dumb-bell, and many others. Large concretions may *present projections* which have formed within the ureters or urethral canal, and which may offer serious interference to their removal.

RATIONAL SYMPTOMS OF STONE IN THE BLADDER.

(1.) *Pain.* This may be confined to the bladder, or radiate through the adjacent parts. It is markedly increased by rough exercise, and often by firm pressure upon the hypogastrium, or in case the rectum be distended. Change in attitude often perceptibly intensifies it.

This pain is usually the most severe in very *large* or *rough* calculi, or in case complicating diseases of the bladder, prostate gland, rectum, anus, urethra, or testicle exist.

(2.) *Frequent Micturition.* This is usually an early symptom. It is due to irritability of the neck of the bladder, and may be greatly aggravated and intensified by inflammation or complicating ulceration of that organ.

(3.) *Interruption of the Urinal Stream.* This is also an early and important symptom. It is due to the closure of the internal urethral orifice by the stone, which, in cases of impaction in the urethra, may cause complete retention of urine. Patients, even in childhood, soon learn some *peculiar attitude* which relieves this tendency, such as crossing of the legs, lying down, stooping, or inclination toward one side during the act of micturition.

(4.) *Pain in the Glans Penis.* This is usually absent in the early stages, and often in old men. It is accompanied, as a rule, by a sense of scalding, smarting, or itching within the urethral canal.

(5.) *Elongation of the Prepuce or Penis.* Patients afflicted with stone in the bladder contract a habit of compressing and pulling upon the glans penis to relieve the pain, by benumbing the sensibility of the part. As a result of this, we have evidence in the appearance of the organ, which is often of great diagnostic value.

(6.) *Changes in the Urine.* In cases where the bladder is irritated by the calculus (as especially exists in old men), the urine becomes characterized by a pus deposit, which gives it a milky or mucilaginous appearance; and, in some cases, blood is quite abundantly mixed with the urine.

The latter ingredient affords a reasonable ground to suspect the presence of either ulceration or of fungoid growth within the bladder.

(7.) *Incontinence of Urine.* If present, this symptom is due either to paralysis, a very large stone, or to some urethral obstruction. It is usually *associated with retention* of urine.

(8.) *Rectal Symptoms.* Prolapse of the rectum in children, and hemorrhoids in the adult, frequently arise from the presence of calculus, when micturition becomes mechanically interfered with.

(9.) *Noise of the Calculi.* Multiple concretions frequently can be heard to jostle against each other, in case of movements of the trunk, as in walking or running.

(10.) *Constitutional Symptoms.* If calculus exist in the aged, the constitutional impairment is liable to be severe. Emaciation, impairment of sleep, dyspeptic symptoms, hectic fever, night-sweatings, colliquative diarrhœa, anxiety of the countenance, and a urinous odor to the patient, indicate rapid dissolution, if the cause be not removed.

PHYSICAL SIGNS OF STONE IN THE BLADDER. The symptom of the greatest diagnostic value, which outweighs all the rational manifestations of this disease, is revealed by the senses of touch and hear-

ing. The introduction of a metallic sound (termed a *searcher*), when brought in contact with the foreign body, yields a peculiar sensation to the touch, similar to that obtained by contact with a foreign substance, and an audible *clicking sound* may often be perceived, especially if the calculus be of moderate size and sufficiently hard to render the sound apparent.

The steps of the operation of "*sounding for stone*" may be enumerated as follows:

(1.) The patient should have been relieved of as much irritation as possible, by previous rest in bed, anodynes, hip baths (if excessive inflammation has existed), and diluent drinks.

(2.) The patient should be placed in such a position, depending somewhat upon the choice of the operator, that the stone shall roll by gravity away from the prostate towards the fundus of the bladder. The position most used is a dorsal decubitus, with the hips greatly elevated.

(3.) The searcher should be hollow, so as to inject water into the bladder, if found to be necessary, and it should be less curved and longer than an ordinary catheter.

(4.) The urine should be retained for some three hours before the operation. In children, a tape is often tied around the penis to insure such an accumulation of urine. If the bladder will not bear such a prolonged retention, a few ounces (usually 3–6) of water will have to be injected through the instrument.

(5.) The instrument should be inserted sufficiently into the bladder to reach the posterior wall. In case the calculus lies near the fundus, it may be felt at once; if not, it should be carefully felt for, the instrument being withdrawn inch by inch. If the stone be lodged behind an enlarged prostate, by reversing *the curve* of the instrument and *drawing it forward*, the point of the instrument may detect its presence.

(6.) As the operation of sounding for stone is not without danger, the period of exploration should be rendered as short as possible.

Errors made in sounding for stone have led some of the most famous surgeons to operate for the supposed existence of a calculus, only to find themselves deceived. The conditions, which have thus misled, may be thus enumerated:

Cancer of the bladder or the rectum.
Osseous cyst of the bladder.
Fibrous, polypoid, or fungoid tumors of the bladder.
Tubercular deposit in the walls of the bladder.
Invagination of the fundus of the bladder.
Prostatic calculi.
Pelvic exostoses.
Prominence of the sacrum.
Malposition of the uterus.

The operation may, furthermore, *fail to give evidence* of a stone which *does exist*, and thus lead to an error in diagnosis. This may occur from one of the following causes:

The small size of the calculus.
A want of experience in the methods of sounding.
Encysted condition of the calculus.
A cul-de-sac behind an enlarged prostate.
A cul-de-sac behind the pubes.
A bilobed bladder.
Inguinal cystocele.
Excess or deficient amount of fluid in the bladder.
Large deposits of lymph or mucus in the bladder.
Dilatation of the ureter.
Excavation of the prostate by ulceration or abscess.

The operation of sounding may sometimes be used to reveal to the touch of the accomplished surgeon the *condition of the bladder*, in cases where the existence of calculi is not suspected.

The points which may be thus gained by the "searcher" may be enumerated as follows:

The *capacity* of the bladder.
The *sensibility* of the bladder.

The *smoothness* of its *inner surface.*
The presence of *ulceration.*
The presence of *sacculations* of the bladder.
The presence of *incrustation.*
The presence of *tumors.*

9. FOREIGN BODIES IN THE BLADDER. These are usually introduced, per urethra, by the patient, either by accident or to elicit sympathy.

10. TUBERCLE OF THE BLADDER. This occurs rarely and always with similar changes in the prostate gland and the kidney.

C. CONDITIONS OF THE BLADDER, NOT NECESSARILY ASSOCIATED WITH STRUCTURAL CHANGES IN THAT ORGAN. This class of abnormal conditions of the bladder includes

1. PARALYSIS OF THE BLADDER. This condition depends upon the existence of some cerebral or spinal lesion. It may follow injury, cerebral or spinal apoplexy, softenings or degenerative changes in the brain or the spinal cord, sexual excesses, shock, fevers, reflex irritation, or poisons.

2. ATONY OF THE BLADDER. This condition frequently accompanies any source of obstruction to the free evacuation of the bladder. It may also follow prolonged voluntary retention of urine, cerebral and spinal affections, fevers, and temporary spasm.

3. SPASM OF THE BLADDER. This condition is seldom unassociated with an exciting cause, as inflammation, calculi, foreign growths, etc. It is indicated by involuntary, uncontrollable, and exceedingly painful contractions of the bladder.

4. NEURALGIA OF THE BLADDER. This is a rare condition. It is associated with many symptoms indicative of stone in the bladder, and is to be diagnosed from it only by the exclusion of that disease.

5. RETENTION OF URINE. This condition may exist in the young, middle-aged, or the old. It usually results from prostatic inflammation, urethral stricture, stone in the bladder, prostatic enlargement, foreign bodies in the urethra, urethral spasm, and urethral rupture.

It may also occur from pressure of pelvic tumors, fracture of the pelvic bones, shock and reflex irritation.

6. INCONTINENCE OF URINE. This is a very frequent condition of childhood, but may also affect adults.

In adults it occurs most frequently in females, as sloughing from pressure, use of instruments in labor, and over-distension of the urethra in removing calculi are frequently followed by it. In men it is seldom unassociated with retention of urine, and is therefore, properly speaking, an *overflow* rather than pure incontinence.

7. OVERFLOW OF URINE. This condition results from an habitual engorgement of the bladder, resulting from a retention of its own secretion.

It frequently results from, or accompanies chronic prostatic enlargement, or organic urethral stricture, and is usually first noticed during sleep, although subsequently any movements requiring the action of the abdominal muscles may produce it, by pressure upon the habitually distended bladder.

Many of these conditions require no special guides to diagnosis, their simple enumeration being sufficient to prevent confusion; many may also *co-exist*, since they are often dependent upon each other not only for their origin, but also for their continuance, and thus variations in the symptoms may be produced, which it is difficult to clearly elucidate. As examples of this, we seldom discover a calculus without inflammatory changes within the bladder, and often lesions of a more advanced character are present; again, retention of urine may *result* from structural disease within the bladder, or, if originally independent of disease within that organ, may *excite* the same by urinary decomposition or by simple distension of the bladder itself.

Inflammatory conditions also, or the presence of obstruction to the free drainage of urine, as from tumors, enlarged prostate, cancer, etc., may, in time, result in the formation of a calculus, the nucleus of which originated either as a plug of mucus, coagulated blood, or an aggregation of urinary salts, precipitated by the ammoniacal reaction of the urine.

It is difficult therefore, as evidenced by these few examples, to

draw marked contrasts between diseases which are so often complicated, and which present, in consequence, the combined symptoms of two affections. Besides, many of the structural changes within the bladder, or its congenital deformities and malformations, cannot be *positively* diagnosed during life, although suspicion may be strongly directed towards the possibility of their existence.

I have arranged therefore, in the form of differential tables, only such conditions of the bladder as seem to me most liable to be confounded in a general surgical practice, or to be capable of accurate and positive diagnosis.

CANCER OF THE BLADDER.	STONE IN THE BLADDER.
PAIN.	
The pain is lancinating in character, and is felt in the pelvis, rectum, back, or hip.	The pain is never lancinating in character, and is felt chiefly in the penis.
The pain is increased by pressure and catheterism.	The pain is often increased by motion or exercise, but is not affected by catheterism.
INTESTINAL SYMPTOMS.	
Intestinal obstruction is frequent.	Intestinal embarrassment is rare.
HEMORRHAGE.	
Hemorrhage is frequent and often severe.	Hemorrhage is less frequent and profuse.
TUMOR.	
A tumor is felt per rectum which is *immovable.*	A tumor may be detected per rectum, and, if so, it is movable.
URINE.	
Blood, pus, cancer cells, *organized tissue,* etc., are often mixed with the urine.	Pus, blood, and crystalline deposits are found often in the urine.
AGE.	
Occurs after the fiftieth year of age.	Occurs at any age.
HISTORY.	
Dyspeptic gastric derangements often precede its development.	An attack of renal colic is frequently the apparent commencement.
CACHEXIA.	
A marked cachexia exists.	No cachexia is present.
SOUNDING.	
Reveals empty bladder.	Reveals presence of a calculus.

SYMPTOMS IN COMMON.

Both are associated with *pain* in expelling the last drops of urine.
" " " " frequent interruption of the stream.
" " " " frequent hæmaturia.
" " " " pus in the urine.
" " " " pain independent of micturition.

RUPTURE OF THE BLADDER.	RETENTION OF URINE.
PERCUSSION.	
Dulness on percussion over the bladder is either absent, or diffused beyond its normal limits.	Dulness over the seat of the bladder always exists, and is markedly circumscribed.
PAIN.	
The pain is not localized, but is rather that of a general peritonitis.	The pain is severe, but is localized in the vicinity of the bladder.
HISTORY.	
A history of traumatism, falls, or severe abdominal contraction upon a distended bladder, exists.	A history of urethral stricture, calculus, or nervous causation is most frequent; but traumatism may produce it.
ORIGIN.	
A sense of tearing is often perceived by the patient.	No sensation of rupture is produced.
CATHETERISM.	
A catheter, if introduced, either fails to reach the urine, or collects abnormal quantities if the peritoneal cavity is filled.	A catheter, if introduced fully into the bladder, always discloses urine and affords immediate relief.
URINE.	
The urine, drawn by the catheter, is frequently *albuminous* from admixture of peritoneal effusion, but no *casts* are detected unless a kidney complication exists.	The urine is generally normal or *ammoniacal,* in case its decomposition has occurred within the bladder from prolonged retention.
INJECTION OF FLUID.	
If water or milk be injected into the bladder through a catheter *no distension* of the bladder is produced as revealed by a searcher.	The bladder is found, on exploration, to be distended after injection of fluids through a catheter.
SEQUELÆ.	
Peritonitis always follows unless the abdomen be opened, the peritoneal cavity washed out, and the rent closed by suture.	No serious results follow, if relief is not too long delayed.

RETENTION OF URINE.	SUPPRESSION OF URINE.
PAIN.	
Great pain, in the region of the bladder, results from distension.	Pain in the bladder is absent.
PERCUSSION.	
Dulness on percussion exists over the distended bladder.	No dulness, over the bladder, is detected on percussion.
TENESMUS.	
Great desire to micturate and vesical tenesmus are present.	No vesical tenesmus, or desire to micturate, exists.
HISTORY.	
A history of urethral stricture, direct injury to the urethra, impaction of a calculus, or some local or nervous cause, is present.	A history of injury over the kidney, surgical procedure, severe exposure, or some infectious disease, etc., is usually present.
CATHETERISM.	
A catheter, when introduced, affords relief by a withdrawal of the retained urine.	No urine in the bladder is usually detected by the introduction of a catheter, nor is relief of symptoms produced in case a small amount of residual urine is discovered and withdrawn.
CONSTITUTIONAL EFFECTS.	
No constitutional effects are produced, provided the condition be not complicated with urinal or local changes.	A *urinous* odor of the skin exists, and rapid symptoms of uræmia develop.

RETENTION OF URINE.	INCONTINENCE OF URINE.
URINAL ESCAPE.	
The urine is totally arrested, none escapes.	There is a continual escape of urine.
BLADDER.	
The bladder is found to be distended, by percussion over its seat.	The bladder may be occasionally found empty, but is generally distended, as revealed by percussion.
CATHETERISM.	
Relief is always afforded by the introduction of a catheter.	The bladder, if *distended* with urine, will be relieved by catheterism.
EXPLORATION OF BLADDER.	
No alteration in the neck of the bladder nor change from its normal power of retention of injected fluids, will be discovered.	In cases of *true incontinence*, the bladder will have a defective power of retaining fluids, as revealed by artificial distension by means of injection into its cavity.
AGE AFFECTED.	
Is frequent in middle life and in old age, but is infrequent in youth.	Is most frequent in youth and old age.
URETHRAL EXPLORATION.	
Urethral stricture or prostatic enlargement is frequently detected, on exploration of the urethra, as an exciting cause of retention.	The urethral canal is often of normal calibre, and free from disease.

ACUTE CYSTITIS.	STONE IN THE BLADDER.
INVASION.	
The invasion of cystitis is often sudden and accompanied by acute symptoms as rigors, fever, vomiting, anxiety of countenance, etc.	The approach of symptoms, due to a calculus, is often insidious and dates from a previous attack of renal colic, in the majority of cases.
PAIN.	
The pain may be located above the pubes, in the perineum, neck of bladder, loins, or thighs.	The pain is most frequently located in the glans penis.
The pain is of a burning character and is rendered *acute* by pressure.	The pain is most increased by exercise, horseback riding, etc., and during micturition, in some cases.
BLADDER.	
The bladder is extremely irritable and cannot retain urine.	The bladder retains urine easily, unless a complicating cystitis exist.
CATHETERISM.	
The introduction of instruments into the bladder produces great pain.	The effects of catheterism are negative, as a rule. Sounding detects the existence of a calculus.
URINE.	
The urine contains mucus in large quantities, often blood and pus. It is frequently alkaline in its reaction.	The urine may contain pus, blood, crystalline salts, or it may be normal in its appearance and reaction.
RECTAL TOUCH.	
No tumor detected.	The calculus often can be felt as a movable tumor.

SYMPTOMS IN COMMON.

Both are associated with *pain* in region of bladder.
" may be " " *urinal changes.*
" " " " frequent and often painful micturition.

PARALYSIS OF THE BLADDER.	ATONY OF THE BLADDER.
DEFINITION.	
Is a condition dependent upon a loss of, or impaired contractile power of the organ from imperfect nervous supply.	Is a condition of temporary loss of contractile power, resulting from obstruction to the free evacuation of the organ, or impaired nutrition.
ORIGIN.	
Paralysis of the bladder is to be diagnosed chiefly by its origin. It may ensue from 1. Injuries to the brain. 2. " " spinal cord. 3. Softening of nerve centres. 4. Apoplexy of nerve centres. 5. Functional derangements of nerve centres. 6. Organic disease of nerve centres. 7. Reflex derangements of nerve centres. 8. Spinal debility from excesses. 9. Shock. 10. Fevers. 11. Poisons, etc., etc.	Atony of the bladder may also be chiefly diagnosed by its exciting causes. Among these may be mentioned 1. Prostatic enlargement. 2. Urethral stricture. 3. Prolonged voluntary retention of urine. 4. Fevers. 5. Poisons. 6. Extreme debility. 7. Acute local inflammations.
IMPROVEMENT.	
The improvement is slow, and often the condition is incurable.	The improvement is rapid if the cause be removed.
FREQUENCY.	
Is a comparatively rare disease.	Is a frequent affection.

CHRONIC CYSTITIS.	CHRONIC PROSTATITIS.
Origin.	
Is a common disease of the bladder, and may occur from 1. Continuation of an acute cystitis. 2. Decomposition of urine. 3. Abnormal condition of urine; as extreme acidity, presence of irritating salts, extreme dilution, etc. 4. Foreign bodies in bladder. 5. Extension of inflammation from neighboring organs.	Is a sequela to an attack of acute prostatitis, or may result from an extension of inflammations from neighboring parts.
Size of Stream.	
The stream may be of normal size.	The stream is diminished in size from tumefaction of the prostate.
Appearance of Urine.	
The urine contains pus, often in large quantities, which assumes the character of a semi-transparent, tenacious, ropy deposit, which rapidly settles in the containing vessel.	The urine is cloudy and may often contain pus and blood in small quantities.
The urine is generally alkaline in reaction, and often ammoniacal in its odor.	The urine is generally acid and is never *ammoniacal*, unless some bladder complication exists.
Pain.	
The pain is not markedly confined to the perineum.	Pain exists in the perineum and rectum. Micturition and sexual intercourse are often painful.
Urethral Discharge.	
No urethral discharge is produced if uncomplicated.	A gleety discharge is often present.
Rectal Examination.	
The prostate gland is normal.	The prostate is *enlarged* and *sensitive.*

DISEASES OF THE PROSTATE GLAND.

The prostate gland may be the seat of the following varieties of disease:

A. INFLAMMATORY DISEASES, under which head may be included

1. ACUTE PROSTATITIS. This disease is seldom a primary affection except when caused by injury. It usually results from an extension of disease from adjacent or associate organs. It is a rare disease in childhood and in old age, but is frequently met with in middle life. It is frequently of gonorrhœal origin, and may, in rare cases, be of idiopathic occurrence.

2. CHRONIC PROSTATITIS. In this condition, prostatic enlargement is always present, provided a previous acute prostatitis existed, but otherwise it may be absent. It is indicated chiefly by a gleet, pus and blood in the urine, weight and dull pain in the perineum and near the anus, painful micturition, pain in sexual intercourse, and frequent nocturnal emissions.

3. PROSTATIC ABSCESS. This condition, when it exists, is almost invariably the result of an acute inflammation of the prostate.

   It most frequently affects the *lateral* lobes of the gland. Abscesses may be solitary or multiple. The seat of rupture may be located in the urethra, bladder, rectum, perineum, or peritoneal cavity. This last-named method of termination, however, is rare, but, when present, is usually followed by fatal inflammation.

B. HYPERTROPHY OF THE GLAND—"PROSTATIC ENLARGEMENT." This condition is one of simple augmentation of the volume of the prostate, dependent upon the increased nutrition of its constitutional elements.

It most frequently affects the whole gland, but not uniformly. The urethra is encroached upon in most cases, and the prostate is increased both in size and in

weight. When the middle lobe of the gland is hypertrophied, a marked obstacle to catheterism is created. This disease is essentially one of advanced age, as it seldom appears, to any marked degree, before the age of fifty. From its mechanical effects it possesses great surgical importance.

C. ATROPHY OF THE PROSTATE. This condition usually occurs as a result of mechanical compression, or of structural disease within the gland.

It accompanies abscess and tubercular deposit in the prostate, and frequently follows prolonged compression from a stone in the bladder. It may in rare cases be a congenital defect or result from simple senile decay.

D. CANCER OF THE PROSTATE. Scirrhus of the prostate is very rare, encephaloid less rare, but by no means common. Both are present most often in advanced life, but no age is exempt from the development of encephaloid cancer. No absolute cause for the appearance of cancer in this region can always be detected, though it may follow the development of a vesical calculus or the formation of a urethral stricture. The duration of the disease seldom, as a rule, exceeds twelve months. It is one of the causes of hæmaturia. Melanotic deposit is said to be occasionally associated with encephaloid of the prostate.

E. TUBERCLE OF THE PROSTATE. This is a condition of extreme rarity and is always associated with a similar condition of the adjacent organs. The volume of the prostate may be either natural, increased, or diminished, though the latter is, by far, the most frequent condition. No absolute diagnosis of this affection can be made during life, although the presence of tubercle may be suspected. The symptoms of abscess are occasionally developed by suppuration around the cheesy masses.

F. CYSTIC DISEASE OF THE PROSTATE. Cysts of the prostate gland are rarely met with; but, when present, they possess a pathological interest.

They are usually multiple, several existing at a time, and they vary in size from a mere speck to that of an olive. Their contents are transparent and consist of either a thick, viscid, albuminous substance, or a thin

serous fluid. These cysts are due, in all probability, to closure of the prostatic ducts and retention of their secretion.

Little is known as to their progress, symptoms, or termination. By some they are regarded as dependent only upon the previous existence of prostatic concretions.

G. PROSTATIC CALCULI. These little bodies are probably the result of a disordered follicular secretion, dependent upon sub-acute or chronic irritation. They are most common in old age, but may exist at any period of life. They consist almost entirely of phosphate of lime.

When very abundant they may destroy the glandular structure of the prostate and become aggregated into one large cyst.

They may often be positively detected during life by introducing the finger into the rectum, while a bulbous bougie is passed in and out of the prostate.

By this means they may be felt as *immovable bodies*, or if encysted, as a bag of small nodules. Their immobility is a symptom of great diagnostic importance.

H. PROSTATIC HEMORRHAGE. Hemorrhage from the prostate is rare, and present usually in the aged, when catheterism is forcibly employed. It may also follow falls upon the nates, riding upon horseback, blows in the perineum, or excessive venereal indulgence. The hemorrhage is occasionally spontaneous, and in these cases is dependent upon some ulceration or granular condition of the mucous membrane, or the presence of a fungous, erectile, or encephaloid tumor. The blood from the prostate is often unmixed with urine, and often precedes and also follows the act of micturition.

I. PHLEBOLITES. By this term is designated earthy concretions within the veins. In the female, the veins of the vagina and uterus, and, in the male, the prostatic plexus of veins are most frequently affected. They usually follow chronic irritation. They consist chiefly of phosphate and carbonate of lime, cemented by a small quantity of animal matter.

J. WOUNDS OF THE PROSTATE GLAND. These are the result either of accident or design. In the latter case they are

made by the surgeon for some useful purpose, as the extraction of stone, etc., etc. Wounds of the prostate gland may be, as respects their character, either incised, lacerated, punctured, or gun-shot.

Wounds, due to accident, may result from forcible catheterism, by inexperienced attempts at extraction of a stone, by fracture of the pelvic bones, by puncture through the perineum or rectum of some pointed stick or instrument, and by gun-shot wounds.

The effects of wounds of the prostate gland may be manifested, either as hemorrhage, inflammation, infiltration of urine and consequent sloughing, retention of urine from tumefaction of the surrounding parts, urethro-vesical or urethro-rectal fistulæ, and abscess either within the substance of the gland or between the gland and the rectum.

If unassociated with wounds of the skin, injuries to the prostate are obscure and often difficult of diagnosis. In old age wounds of the prostate are associated with serious hemorrhage. This is explained on the ground of the great increase in the size and the varicose condition of the prostatic plexus of veins.

I have in the preceding pages briefly sketched the general outlines of diseases of the prostate gland.

In some instances I have enumerated, in connection with the description of the disease, the few points upon which our present means of diagnosis of these obscure diseases rest. Atrophy, cancer, tubercle, cystic disease, prostatic calculi, and phlebolites may often exist unsuspected during life, as the symptoms are frequently of a vague and imperfect character. I have, however, arranged in the form of tables the points of contrast between the inflammatory affections of the prostate and the distinctions to be drawn between hypertrophy of the prostate gland and organic urethral stricture.

ACUTE PROSTATITIS.	CHRONIC PROSTATITIS.
HISTORY.	
Is usually of traumatic origin, or follows an extension of inflammation from other parts.	Is secondary to the acute form, or may follow a gonorrhœa by an extension of that disease backwards.
PAIN.	
The pain is violent and pulsatile, situated deep in the perineum in front of the anus, and is augmented by pressure.	The pain, when present, is local and confined to the pelvis, usually in the rectal region.
RECTAL SYMPTOMS.	
Rectal tenesmus and marked pain during defecation are usually present.	Rectal tenesmus is often absent, and defecation is seldom painful.
URINE.	
The urine is high colored, and may contain pus or blood.	The condition of the urine is affected by the weather, habits of the patient, and the amount of exercise taken.
Retention of urine is frequent.	Retention of urine is infrequent.
RIGORS.	
Rigors are frequent if suppuration occurs.	Rigors are seldom present.
RECTAL EXAMINATION.	
The prostate, when examined per rectum, is hot, enlarged and tender. In case suppuration occurs it often becomes fluctuant.	The prostate exhibits local sensitiveness to the touch and enlargement. It seldom, if ever, goes on to suppuration, and is therefore not fluctuant.
ABSCESS.	
Pus may form and escape through the urethra, bladder, rectum, pelvic fascia, or perineum.	Abscess is of rare occurrence.

SYMPTOMS IN COMMON.

Both may be associated with *frequent micturition.*
" " " " *pain* during *micturition.*
" " " " elevation of pulse and temperature.

HYPERTROPHY OF THE PROSTATE.	ORGANIC URETHRAL STRICTURE.
AGE AFFECTED.	
Is most frequent after fifty.	Occurs at any age, but *usually* after puberty.
HISTORY.	
A venereal history is often absent.	Is commonly associated with a venereal history.
MICTURITION.	
The length of the act of micturition is often hastened by attitude.	Micturition is prolonged, as a rule, but is unaffected by attitude.
BLADDER.	
A sense of incomplete evacuation is often present in the bladder.	No abnormal sensations are present in the bladder if not diseased.
URINE.	
The urine is frequently ammoniacal from decomposition of the residual urine retained by the enlarged prostate.	The urine is seldom ammoniacal, as the bladder can empty itself completely.
Pus, mucus and blood are common ingredients.	No abnormal deposits exist, save when complications are present.
RECTAL EXPLORATION.	
The finger when introduced into the rectum detects the enlargement of the prostate.	The prostate is found to be of normal size, by rectal examination.
URETHRAL EXPLORATION.	
Bulbous bougies reveal a perfectly normal urethra in front of the prostatic region, if uncomplicated.	Bulbous bougies, or a urethrometer, reveal the seat, calibre and length of the urethral constriction.

SYMPTOMS IN COMMON.

Both are associated with a *prolongation of the act of micturition.*

" " " " *impairment* of the *force* and *size* of the urinal stream.

" " " " frequent retention of urine.

" " " " hemorrhoids from straining.

" " " " changes in bladder, kidneys and ureters.

DISEASES OF THE URETHRA.

The surgical diseases of the urethral canal may be classified into

A. INFLAMMATORY DISEASES.

Under which head may be embraced

1. GONORRHŒAL INFLAMMATION. This condition depends upon the contact of a *specific poison* with the urethral mucous membrane. It is characterized by all the symptoms of acute catarrhal inflammations, and when long continued, results in new connective-tissue formation outside of the urethral walls. It is the most frequent cause of organic stricture. It is evidenced by local engorgement, a purulent discharge, pain in micturition, and occasionally by constitutional disturbance.

2. "URETHRITIS," or, NON-SPECIFIC INFLAMMATION. This condition is produced by local irritation, and not by the contact of a specific gonorrhœal poison. It differs from the former type of disease in the absence of its severe local symptoms and the amount of the discharge. It may result in the formation of stricture if of protracted duration. It is a rare affection.

   In very acute forms, urethritis is, clinically, closely allied to gonorrhœal inflammation.

3. LOCAL ULCERS, of the CHANCROIDAL or SYPHILITIC VARIETY. This type of disease will be considered, in all its bearings, in subsequent pages, arranged in the form of a diagnostic table.

B. DISEASES OF THE URETHRA, AFFECTING THE STRUCTURE OF ITS COATS.

Under this head may be embraced

1. URETHRAL STRICTURE (organic). Under the term urethral stricture I include only *abnormal organic contraction* of the urethral canal. It may present the following types: 1. *Annular*, where a localized ring of contraction exists, as if an external cord were tied around

the urethra. 2. *Linear*, where an elevated ridge exists, parallel to the long axis of the urethra. 3. *Indurated Annular*, or "hour-glass" stricture, where the constricting ring is indurated or thickened at its base. 4. *Tortuous*, where the urethral canal is irregularly constricted. 5. "*Bridle* stricture," where bands extend transversely across the urethral canal.

It may result from specific or non-specific inflammation, from cicatrizations or adhesions within the urethra, from abnormal urethral growths, and from congenital malformation.

Its early symptoms are chiefly gleet, alterations in the size of the urinal stream, and interference with the act of micturition. Its later symptoms depend upon changes in neighboring parts, produced by its mechanical interference with the free escape of urine, and may be localized within the bladder, rectum, kidney, perineum, or testicle.

The diagnosis of urethral stricture, to be complete, must determine the following points:

The situation of the stricture.
The length " "
The calibre of the opening.
The variety of stricture present.
The condition (as regard its sensibility).

To accomplish all these requirements, the following aids are employed:

(1.) *Bulbous bougies*, which are larger at the inserted end than in the shaft, and can thus be arrested only at the *point*. They thus indicate the *exact situation* of the anterior portion of the stricture, by measurement being taken of the portion inserted, after its withdrawal. They are more reliable than a *solid* instrument, since they are incapable of dilating a stricture during their passage; and they thus render the detection of existing strictures comparatively free from a percentage of error.

They are capable of recording also the *calibre* of the constriction. The urethra should be

completely filled by the bulb of the *first bougie* introduced, and, if that be arrested, smaller sizes should be introduced, till one will pass through the orifice of the stricture. The meatus of the urethra may, possibly, have to be divided, in some cases, before one sufficiently large to fill the urethra can be first introduced.

(2.) *The urethrometer*, invented by Dr. Otis, is a still more reliable and accurate means of diagnosis. It consists of an instrument which is introduced into the urethra as far as the *bulbous portion* of the canal, when, by means of a screw in the handle of the instrument, a bulbous projection is expanded at the inserted end, till a *sense of moderate distention* is perceived by the patient. The instrument is then drawn forward until arrested, as it will be, if strictures exist, when the bulb is reduced in size sufficiently to pass the constriction. A dial upon the instrument records the first measurement as that of the *normal urethra*, and the second, as that of the *calibre of the stricture*. Several successive strictures can be thus measured, provided the instrument is screwed up to the normal urethral measurement after each constriction is passed.

(3.) The *endoscope*, in some cases, enables the surgeon to perceive the character of the urethral mucous membrane for nearly its whole extent, and often to examine the orifice of an existing stricture. It is of the greatest value, however, in deciding upon questions of the *condition* of *concealed mucous surfaces*. As an aid to the diagnosis or treatment of urethral stricture, I have found it of little value.

(4.) The *sensations* of the patient during instrumentation are often of great assistance to the surgeon in determining the condition of the mucous membrane of the urethra, since the presence of *localized spots of extreme tenderness* often indicate a condition which has been called "granular urethritis" by some authors, and which, by some, is considered as the formative stage of urethral

constriction. The presence or absence of a *tendency to hemorrhage*, the *sensation given to the touch* as the instrument passes the stricture, and the *amount of induration* detected by an external examination, are also of great value in determining the exact condition of the urethral canal, but they can only be fully appreciated in their bearings by those having a large practical experience in such examinations.

An accomplished urethral surgeon should be able, by the sense of touch alone, to appreciate the length and character of a stricture; and also to detect the entrance of an instrument into a false passage, where the mucous lining is generally absent, since the sensation afforded the surgeon by means of the instrument differs in that case from that afforded by the mucous lining of the normal canal.

2. URETHRAL DILATATION. Urethral dilatation occurs most frequently at the membranous portion of that canal. It is due to obstructed evacuation of urine. It results in the formation often of a perineal tumor, which appears only during micturition. It is a frequent cause of urethral rupture.

3. URETHRAL RUPTURE. This condition may be of traumatic or spontaneous origin. It follows blows or lacerations in the vicinity of the perineum, or it may result from a previously existing local dilatation of the urethra.

It may occur either within the membranous portion, immediately in front of the triangular ligament of the perineum, or anterior to the peno-scrotal junction. It seldom, if ever, affects the prostatic portion of the urethra, unless as the direct result of injury or abscess of the prostate.

Rupture of the urethra is always followed by, or accompanied with extravasation of urine. The symptoms produced by this extravasation differ with the *locality* of the seat of rupture. In all cases, however, if the urine be retained outside of its normal channels, sloughing occurs from decom-

position of the retained urea into carbonate of ammonia and the excessive inflammation produced by it, though the symptoms accompanying this destructive process may vary greatly with the locality affected.

4. URETHRAL DEFORMITIES. The deformities of the urethra may be congenital or acquired. In rare cases, the meatus may be located at the side of the glans penis, the urethra may terminate in the groin, the ejaculatory ducts may open as a separate canal on the dorsum of the penis behind the glans, enormous congenital dilatations of the urethra may exist, congenital stricture, and valvules pointing backwards and obstructing the flow of urine but not the passage of instruments, have been reported.

Atresia, hypospadias, and epispadias, are, however, the deformities of the urethra most frequently encountered.

5. URETHRAL TUMORS. The tumors of the urethra may be either polypi, vascular granulations, tubercle, or cancer. The first two are most frequently located in the prostatic portion of the canal.

Tubercular or cancerous deposits in the urethra are rarely primary, but are secondary, as a rule, to similar conditions of the bladder, prostate gland, or kidney, which have reached an advanced stage in the disease.

6. URETHRAL ABSCESS. Urethral abscess is most frequently located at the fossa navicularis, the bulb of the corpus spongiosum, or in Cowper's glands. The latter condition is denominated "Cowperitis" by some authorities. When the fossa navicularis is affected, the tumor appears on one side of the frænum, but if the bulb or Cowper's glands are affected the tumor is situated in the perineum.

In either case the symptoms are those of abscess, and the causation is usually gonorrhœal.

7. URETHRAL FISTULÆ. These may exist in the perineum, scrotum, groin, nates, penis, or even above the symphysis pubis in case of extravasation of urine. Uri-

nary fistulæ may be classified as 1. Simple fistulæ where the surrounding parts are normal. 2. Fistulæ complicated by inflammatory induration and deformity of tissues. 3. Fistulæ dependent upon destruction of the soft parts by sloughing.

Fistulæ of the urethra are generally associated with urethral stricture or abscess, but they may follow impaction of calculi or foreign bodies. They also result from injury causing a rupture of the urethra, and, in rare cases, are congenital.

C. Conditions impeding the Normal Exit of Urine and Independent of Structural Changes. This class of conditions embraces:

1. Urethral Spasm. This condition seldom, if ever, exists to a degree sufficient in itself to prevent or impede the normal power of expulsion of urine, except when complicated by organic stricture. It is developed, when present, to the greatest degree in the *membranous* portion of the urethra, in which location the compressor urethræ muscle assists the involuntary muscular fibres of the urethral walls. It may result from acid urine, cantharides, turpentine, alcohol, repressed gonorrhœal discharge, organic stricture, and rectal diseases.

It is associated with marked and intermitting variations in the size of the stream, and if uncomplicated by organic stricture should disclose a normal degree of patency of the urethra after the attack has subsided.

2. Congestive Stricture. This variety of stricture is always dependent upon turgescence of the urethral mucous membrane, arising from an inflammatory condition of that part. It is always associated with more or less spasm of the urethra, and, like that disease, is to be diagnosed from organic contraction by the existence of a normal urethral calibre after the attack has been relieved.

3. Urethral Calculi. These bodies are usually derived from the kidney or the bladder, but, in rare instances, may form behind an urethral obstruction

They may be single or multiple, and may be associated with retention of urine, or an absence of symptoms of obstruction. If not removed, dilatation of the urethra, ulceration, and frequently rupture, follow.

4. FOREIGN BODIES IN THE URETHRA. Foreign bodies are frequently introduced into the urethra either through accident or during attempts to relieve retention of urine, or to induce sexual excitement by the friction of some extraneous substance upon the urethral walls. Thus pieces of slate pencil, heads of wheat, leather thongs, hair-pins, etc., etc., have, in numerous cases, been reported as present in the urethral canal.

RUPTURE OF THE URETHRA WITHIN THE TRIANGULAR LIGAMENT.	PERINEAL ABSCESS.
ORIGIN.	
Appears as a sudden tumor in the perineum, associated with an indistinct sense of rupture and abnormal sense of warmth in the perineum.	Begins as a slowly increasing tumor in the perineum.
PREVIOUS HISTORY.	
A previous history of urethral stricture is usually present, but no premonitory manifestations of rupture may have existed.	A sense of heat, local pain and soreness have usually preceded the development of the tumor.
FLUCTUATION.	
Fluctuation is present from the onset.	Fluctuation appears late.
TUMOR.	
Is elastic and tense from the onset, until it burrows or escapes from the perineum.	Is hard and œdematous in its early stages, but becomes, later on, fluctuant and elastic.
MICTURITION.	
Retention of urine is frequent and follows rapidly upon the appearance of the tumor.	Retention of urine is seldom present, but, if so, it occurs late in the disease.
EXTENT OF INFLAMMATION.	
The scrotum, abdominal walls and thighs, may become rapidly implicated when the tumor leaves the perineum.	The inflammation and suppuration are confined solely to the perineum.
RESULTS.	
Tends towards rapid sloughing.	Tends towards pointing and the evacuation of pus.

SYMPTOMS IN COMMON.

Both are associated with a *perineal tumor.*
" " " " possible *retention of urine.*
" " " " *suppuration.*
" " " " *fluctuation.*

RUPTURE OF THE URETHRA IN THE MEMBRANOUS PORTION.	RUPTURE OF THE URETHRA IN FRONT OF THE TRIANGULAR LIGAMENT.
TUMOR.	
The tumor is, at first, *confined to the perineum.*	The tumor is never confined to the perineum.
SCROTUM.	
If the scrotum be distended by urine, it is only involved after sloughing of the triangular ligament has freed the imprisoned urine.	The scrotum is frequently distended from the onset of the attack and appears red, tense and œdematous.
ABDOMEN.	
The abdominal walls often escape infiltration by urine, and subsequent sloughing.	The abdominal walls frequently become involved before the tension of the scrotum is relieved by incision or by sloughing.
THIGHS.	
The thighs are involved late, if at all.	The thighs are often infiltrated early.
PELVIC ORGANS.	
The pelvic organs may undergo sloughing or a general peritonitis may ensue, from extension of the urine into the pelvic fascia.	The pelvic organs are never involved, as the imprisoned urine escapes before the sloughing process, produced by it, is sufficiently extensive to involve the deeper structures.

RUPTURE OF THE URETHRA IN FRONT OF THE SCROTUM.	FRACTURE OF THE PENIS.
ORIGIN.	
May be of spontaneous origin, or due to traumatism.	Is always due to injury.
It usually follows and is dependent upon *urethral stricture.*	Is not dependent upon urethral stricture or any diseased condition.
PENIS.	
The penis is red, swollen, tense and œdematous.	The penis is greatly swollen and ecchymosed, or, hemorrhage may exist through the urethra or integument.
INTEGUMENT.	
The integument is always intact, but is distended.	The integument may be lacerated.
HISTORY.	
A history of the appearance of the tumor during attempt at micturition is usually present, provided the rupture was not traumatic.	The history of some accident to the genital organ while in the state of erection, is usually present.

SYMPTOMS IN COMMON.

Both are associated with great swelling and deformity.
" " " " frequent retention of urine.
" " " " frequent sloughing.
" " " " frequent suppuration.
" " " " possible permanent deformity after recovery.

ORGANIC STRICTURE OF THE URETHRA.	ENLARGED PROSTATE.
AGE AFFECTED.	
Occurs at any age, but usually after puberty.	Is most frequent after the age of fifty years.
HISTORY.	
Is commonly associated with a venereal history.	A venereal history is often absent.
MICTURITION.	
Micturition is prolonged, as a rule, but is unaffected by attitude.	The length of the act of micturition is often hastened by attitude.
BLADDER.	
No abnormal sensations are present in the bladder if not diseased.	A sense of *incomplete evacuation* is always present in the bladder.
URINE.	
The urine is seldom ammoniacal as the bladder can empty itself completely.	The urine is frequently ammoniacal from decomposition of the residual urine retained by the enlarged prostate.
No abnormal deposits exist, save when complications are present.	Pus, mucus and blood are common ingredients.
RECTAL EXPLORATION.	
The prostate is found to be of normal size, by rectal examination.	The finger, when introduced into the rectum, detects the enlargement of the prostate.
URETHRAL EXPLORATION.	
Bulbous bougies, or an urethrometer reveal the seat, calibre and length of the urethral constriction.	Bulbous bougies reveal a perfectly normal urethra in front of the prostatic region, if uncomplicated.

SYMPTOMS IN COMMON.

Both are associated with a *prolongation of the act of micturition.*
" " " " *impairment* of the *force* and *size* of the urinal stream.
" " " " frequent retention of urine.
" " " " hemorrhoids from straining.
" " " " changes in bladder, kidneys and ureters.

ORGANIC URETHRAL STRICTURE.	URETHRAL TUMORS.
SEX AFFECTED.	
Is principally a disease of males.	Urethral tumors affect both sexes and may be of two great varieties, polypoid and vascular. In males the polypoid tumors are most common; in females, the vascular, or fleshy tumors are usually present.
LOCATION.	
Urethral stricture is never detected in the prostatic portion of the urethra and seldom behind the *bulb* of the corpus spongiosum.	In males the tumors are most frequent just within the meatus, but they may affect the *membranous* and *prostatic* portions of the urethra.
PAIN.	
Urethral strictures are sensitive, often, to the touch, but rarely give pain except during micturition.	The vascular tumors are extremely painful and sensitive, but the polypoid tumors are painless.
ORIGIN.	
Strictures are most frequently of gonorrhœal or traumatic origin.	The origin of these tumors is unknown.
HEMORRHAGE.	
Strictures seldom cause spontaneous hemorrhage.	The polypoid tumors seldom bleed, but the vascular tumors often bleed profusely.
MOBILITY.	
Strictures are constant in their situation and immovable.	Polypoid tumors may be movable with the urethra.

SYMPTOMS IN COMMON.

Both may produce a small stream.
" " " prolonged and painful micturition.
" " " a gleety discharge.
" " " subsequent diseases of adjacent organs.
" " " impaired general health.

DISEASES OF THE PENIS.

The diseases to which the penis is subject may be divided into four groups as follows:

A. DISEASES OF THE GLANS PENIS: under which head may be enumerated the following conditions:

1. BALANITIS. This term is used to designate an inflammation of the surface of the *glans penis*. It occurs most frequently in persons of gouty habit, or those possessing an irritable skin. It results often in those not predisposed to its occurrence, from retention of the smegma preputii, from contact with gonorrhœal, menstrual, or leucorrhœal discharges, from lack of cleanliness, and from other sources of irritation.

   Its symptoms are similar to those of the following disease.

2. POSTHITIS. By the term posthitis, is meant an inflammation of the mucous membrane of the *prepuce*. Its causes and symptoms are identical with those of balanitis. The mucous membrane becomes reddened, mottled and often ulcerated. A purulent discharge is present which arises from the surface of the glans, and not from the urethra. A sense of burning and itching at the penis exists, and scalding during micturition may often be present.

   Inflammatory phimosis often occurs from swelling of the prepuce, and warty vegetations are a common result of a prolonged balanitis or posthitis.

3. HERPES PROGENITALIS. This type of the herpes eruption appears either upon the glans, the mucous or cutaneous surface of the prepuce, or even upon the body of the penis. It is indicated by the formation of clusters of small vesicles, which often ulcerate when exposed to moisture, as when within the preputial covering, and assume, in rare cases, an angry and deep character. These ulcers more frequently tend, however, towards recovery, but in some in-

stances vegetations, balanitis or inflammatory phimosis result as sequelæ.

4. VEGETATIONS and VENEREAL SORES. "*Venereal warts*" may be located either upon the glans, prepuce, scrotum, anus, or, in some cases, within the urethral canal. Their common designation is a misnomer, as they are more often due to simple irritation than to a venereal origin.

They are frequent in children and in pregnant women, who are troubled with irritating vaginal discharge. They are almost invariably multiple. True *venereal ulcers* however are frequently found in the same situations as are venereal warts. They are of two great types: *chancroid* and *chancre*; the former being a purely local disease, the latter being a local evidence only of an existing blood *condition*. These two diseases are due to the presence of a specific poison, and will be considered in contrast in subsequent pages of this work.

5. EPITHELIOMA. This form of cancer most frequently attacks the glans penis and prepuce, and occurs usually after the age of forty. It is characterized by all the general symptoms of epithelioma in other parts of the body. It will be more exhaustively considered under the head of tumors.

B. DISEASES OF THE PREPUCE: under which head is embraced the conditions of phimosis and paraphimosis.

1. PHIMOSIS. The prepuce may be incapable of retraction over the glans from absence of the opening (atresia preputii), from inflammation, from adhesion, and from congenital defect. It is a normal condition in infancy, and, unless sufficient to cause *inflation* or "ballooning" of the prepuce during attempts at micturition, need cause no surgical interference. Phimosis tends, if extensive, towards imperfect development of the glans penis.

It may also produce balanitis, cystitis, spermatorrhœa, and reflex nervous diseases, if severe in extent and long continued, especially if adhesions exist.

2. PARAPHIMOSIS. Paraphimosis may be the result of an accidental retraction of a tight preputial orifice over the glans penis, or it may occur as a result of inflammatory œdema, when the preputial orifice has always exhibited a normal condition.

   This latter condition often accompanies balanitis, gonorrhœa, chancroid, chancre, or even a severe attack of herpes. It occurs, as a rule, during attempts to apply local treatment to the existing condition of the glans penis.

   In all forms of paraphimosis the glans becomes rapidly swollen and livid in appearance, from the obstructed venous return, and thus increases the difficulty of reduction. If not rapidly relieved, sloughing occurs, and destruction of the glans or a urinary fistula is liable to be produced.

C. DISEASES OF THE CORPORA CAVERNOSA: under which head are included the following conditions:

1. INFLAMMATION. This condition is always one of serious import. It may arise spontaneously from a severe gonorrhœa, or in connection with the exanthematous fevers. It also follows contusions and fracture of the penis. As a rule, suppuration and gangrene result when the inflammatory process is severe. The local pain is very excessive. It is a rare disease.

2. CALCIFICATION OF THE PENIS. This condition is analogous to atheroma of the blood-vessels. It is insidious in its approach, occurs in middle life or old age, and is first denoted by an imperfect and painful erection of the penis, the organ being bent where calcification has occurred, as the fibrous sheath loses its elasticity in consequence of the osseous deposit. In advanced cases osseous plates can be detected in the body of the organ.

3. GUMMATA. Gummy tumors may, in rare cases, affect the genitals in advanced stages of syphilis. They are to be diagnosed from fatty, fibrous, cystic and erectile tumors, which may also affect the penis. This can be easily done by the previous history of the patient, and the tendency of gummata to sup-

purate and discharge. Gummata seldom reach a large size.

4. Chronic Circumscribed Inflammation. This affection is very rare. It consists of a local inflammatory induration, the cause of which is unknown, producing a deformity of the penis during erection.

The indurated mass has *elasticity*, and differs in this respect from the osseous plates produced by calcification. It is usually superficial, with well-defined edges, and is slowly progressive in development, or occasionally stationary for an indefinite period.

5. Fracture of the Penis. The fibrous sheath *of the* corpora cavernosa is occasionally ruptured and the adjacent erectile tissue is involved. This condition constitutes the so-called fracture of the penis. It is always accompanied by extensive extravasation of blood, and, in severe cases, may terminate in gangrene. It is produced by injuries received while the organ is in a state of erection. It terminates usually in recovery, when treated early, but may leave a deformity in erection or a nodular swelling at the seat of fracture, which may render subsequent sexual intercourse difficult and painful.

By some authors the voluntary or spontaneous rupture of a *chordee* during a violent attack of gonorrhœa or non-specific inflammation, is regarded as a variety of fracture of the penis. In this case, however, the corpus spongiosum only is involved, and, as the blood escapes through the urethra, little local deformity is the immediate result, although a severe form of organic stricture inevitably follows.

D. Anomalies of the Penis. The penis may be rudimentary in size, or may in rare instances be enormously developed. It may also be double, as is reported by several authors; and in one case described by Nélaton was congenitally *absent*. These unnatural conditions, however, have little surgical importance, as nature, usually, provides a means of free urinal escape, and the general health is therefore unimpaired.

I have in the preceding pages briefly enumerated the principal surgical diseases of the genital organ. Many of them are infrequent, and can be excluded as probable causes of confusion in diagnosis on that ground; while others are too clearly marked in their symptoms to need further elaboration. I have added, however, the distinctive points of diagnosis between chancroidal ulcers and the syphilitic sore, as they are frequently a source of doubt to the practitioner, and as a radical difference in the prognosis and treatment depends upon an early recognition of the disease existing.

CHANCROID.	CHANCRE.
Nature of Ulcer.	
Is a purely local affection.	Is a local manifestation of an existing blood disease.
Incubation.	
The ulcer develops immediately after absorption of the poison :— 24 hours to third day after infection.	The ulcer develops from 10 to 24 days after infection, as a rule.
Shape of Ulcer.	
The ulcer is round, as a rule, but may be oval, or irregular from fusion of multiple sores.	Is generally circular or oval.
Edges of Ulcer.	
Are clean-cut, perpendicular, often everted and undermined.	Are smooth, often elevated, adherent, not undermined, and gradually melt into the floor of the ulcer.
Floor of Ulcer.	
Uneven, honey-combed, warty or irregular, without lustre.	Smooth, often concave, and shining.
Color of Ulcer.	
Yellowish ; often a reddish or violet areola exists around the sore.	Grey in centre, darker at edges, sometimes scabbed ; areola is often absent.
Situation.	
Rarely present except on, or near the genitals.	May exist on genitals, head, hands or nipple.
Causation.	
Contact with chancroidal ulcer or inoculation with its pus.	Contact with primary sore, a secondary lesion of syphilis, vaccination, or inoculation upon an abrasion of the surface.
Pain.	
Is usually painful.	Is usually painless and indolent.
Number.	
The ulcers are seldom single.	A *solitary* sore is usually present.

CHANCROID (*continued*).	CHANCRE (*continued*).
METHOD OF ORIGIN.	
Begins as a pustule, or an ulcer and remains an ulcer.	Begins as a papule or an erosion, and remains an erosion or ulcerates.
SECRETION.	
Ichorous and irritating pus in first stage; but laudable when ulcer is healing.	Scanty and serous in character, unless the sore be irritated when it becomes purulent.
INDURATION.	
Is absent, unless the ulcer be irritated; is not elastic or abrupt in its termination, subsides after the irritation is removed, is adherent to the skin and sensitive to pressure.	Often precedes the sore, and lasts long after its disappearance. It is hard, elastic, cartilaginous, usually hemispherical in shape and abrupt in its outline. It is very *movable* and *never sensitive* to pressure.
INOCULABILITY.	
Is auto-inoculable, is transmissible and can be communicated to animals.	Is not auto-inoculable unless irritated, and is transmissible only to human species.
BUBO.	
Suppuration of the lymphatics of the groin is frequent. The bubo is usually painful and mono-glandular.	The enlarged lymphatic glands in the groin are usually *painless, multiple*, and *seldom suppurate*, unless injured or due to a mixed infection.
EXTENT OF ULCER.	
Is often of large extent from an accompanying phagadæna, and severe in its local results.	Is seldom phagadenic, and shows little tendency to spread.
DURATION.	
Often lasts from one to two months.	Is slow in development, but heals rapidly when once reparative processes commence.
CICATRIX.	
Not distinctive.	Pigmented, as a rule.
RESULTS.	
No constitutional symptoms are developed.	Secondary symptoms of syphilis rapidly appear.

HERPES.	BALANITIC ABRASION.
Origin.	
It may occur from cold, fever, or a nervous condition, as well as from friction, irritation, or the chemical action of acrid discharges.	It follows only friction, mechanical irritation, or the contact of acrid discharges from the glans or prepuce.
Locality.	
May be a local disease only, or may exist as an evidence of an abnormal nervous condition in other parts simultaneously.	Is always a local affection.
Development.	
It begins as a group of vesicles.	Begins as an abrasion or a fissure.
Pain.	
Is associated with a stinging and burning sensation as it develops.	Is painful and sensitive.
Tendency to Recur.	
A marked tendency to recur at regular intervals is often exhibited. It is often induced to return by dissipation or excessive venery.	No tendency to periodical relapses is present, but it may be reproduced by a return of the exciting cause.
Appearance of Ulcer.	
Is rounded in its shape, often slightly irregular, and its borders may disclose the remnants of previous vesicles as segments of small circles.	Resembles a chancroidal ulcer when fully developed.

SURGICAL DISEASES

OF THE

ABDOMINAL CAVITY.

SURGICAL DISEASES OF THE ABDOMINAL CAVITY.

UNDER this head will be considered, in this volume, the following named conditions,

A. INJURIES OF THE ABDOMEN. The injuries to the abdomen may be of three varieties, as follows:

1. CONTUSION OF THE ABDOMEN. Contusions of the abdomen may be present with or without rupture of the viscera. In either case such an accident is frequently accompanied with intense pain, faintness or syncope and vomiting.

In some cases death has occurred by an impression made upon the solar and cardiac plexuses, without any internal lesion being discovered.

Contusions of the abdomen may produce either rupture of muscles, extravasation of blood, rupture of the peritoneum, rupture of the diaphragm, rupture of the stomach or intestine, lacerations of the liver and spleen, rupture of the gall-bladder, or lacerations of the kidney and the ureter.

Contusions of the abdomen usually occur from flying objects, as cricket-balls, etc., etc., from blows received during altercations, from falls upon the abdomen, cart-wheels passing over the body, or from some other similar misfortune. If uncomplicated by injury to viscera, contusions of the abdomen may result in abscess or recovery.

2. WOUNDS OF THE ABDOMEN. Wounds of the abdominal parietes may be either superficial or deep, and may be associated with the absence of complications, or the protrusion, and possible injury of adjacent viscera.

They may occur from sharp and pointed instruments, from being impaled upon iron spikes, caught

upon iron hooks, tossed by horned cattle, injured by glass, china, or missiles, or by the bites of carnivorous animals.

Wounds of the abdomen may vary therefore greatly in appearance, variety, extent and location. They may be complicated with serious hemorrhage and with the introduction of foreign substances into the abdominal cavity through the wound, even in case the viscera escape injury.

The intestines, stomach, liver, spleen, bladder, omentum, and mesentery may protrude, in case the location and character of the wound favor such a displacement.

Artificial anus may result in cases of wounds of the abdominal parietes, although it is a more frequent sequela of diseased conditions of the intestine associated with sloughing.

3. Foreign Bodies in the Intestinal Canal. Foreign bodies which are proof against the action of the gastric or intestinal juices are often introduced into the stomach either by accident or with design. The foreign bodies often detected include coins, bullets, fruit-stones, pebbles, marbles, hair, string, oat-husk, pins, fish-bones, false teeth, etc., etc.

The results of the introduction of foreign bodies into the stomach differ with the size and shape of the body introduced.

Small, flat, or oval bodies may be voided without delay, pain, or other symptoms of disturbance. If hair, string, or similar substances, be present in the stomach, they often attain immense size, and, by remaining within that organ, frequently produce symptoms of severe dyspepsia, and subsequently those of ulceration and perforation of its coats.

Irregular-shaped or globular bodies frequently become arrested at the ileo-cæcal valve, if allowed to pass the pyloric orifice of the stomach.

Sharp or pointed bodies are best voided by plentiful eating and the avoidance of cathartics, as, by so doing, the foreign body is more liable to be inclosed in the abundance of fæcal material.

Needles when swallowed often penetrate the walls of the alimentary canal and are transported to distant points often before their removal.

B. DISEASES OF THE INTESTINE:

1. FÆCAL ABSCESS. Abscess of the abdominal region is often dependent upon an artificial aperture in some portion of the alimentary canal. It may arise from perforation of the bowel as a sequel to simple ulceration, the lodgement of a foreign body in the intestine, ulceration of the gall-bladder from a gall-stone, stricture of the intestine, cancerous disease of the bowel, or fæcal impaction as a result of muscular atony or paralysis, dependent upon previous catarrhal inflammation of the intestine.

   The most frequent seat of fæcal abscess is in the region of the ilio-cæcal valve—the right iliac fossa; but abscess may be present in any portion of the abdominal cavity.

   Fæcal abscesses follow no definite rule as to symptoms, rate of progress, or termination.

   They may develop slowly and insidiously, or rapidly with severe local pain and marked constitutional disturbance followed by symptoms of a general peritonitis. In the diagnostic table between typhlitis and perityphlitis will be found embodied the principal features of abdominal abscess.

2. INTESTINAL OBSTRUCTION. Intestinal obstruction may develop suddenly or slowly. When the attack is of sudden advent, and the symptoms markedly acute, the result is usually fatal to life; but when slowly developed frequent relief can be afforded or recovery take place, without assistance, even when all hope of life may have vanished.

   The causes of *sudden* intestinal obstruction include, 1. Foreign bodies, either artificially introduced or formed within the intestine. 2. Congenital stricture or malformations of the intestine. 3. Twisting of the intestine or "*volvulus.*" 4. Obstructions from peritoneal adhesions. 5. Invagination of

the bowel or "*intussusception*," resulting from intestinal tumors, worms, or unexplained causes. 6. Thickened peritoneal coverings and mesenteric attachments from an old hernial protrusion; and 7. strangulated hernia.

The causes of *gradual* intestinal obstruction may be 1. Tumors pressing upon the bowel. 2. Simple stricture of the bowel from ulceration, injury, etc. 3. Cancer of the bowel occluding its normal calibre. 4. Tubercular peritonitis. 5. Abscess from traumatism of abdominal walls. 6. Constipation or impaction of fæces. 7. Inflamed and thickened intestine as the result of injury.

The prominent symptoms of intestinal obstruction are 1. Local and severe pain. 2. Obstinate constipation. 3. Presence, often, of a tumor. 4. Localized dulness, if the tumor cannot be felt. 5. Vomiting, which becomes stercoraceous. 6. Tympanites. 7. Symptoms of general peritonitis or collapse.

C. DISEASES OF THE RECTUM. The rectum may present the following surgical conditions:

1. HEMORRHOIDS. These are of two varieties, external and internal; the former being located at the anus, the latter higher up within the rectum. They are both due to a varicose condition of the hemorrhoidal veins. They are largely dependent upon portal obstruction.

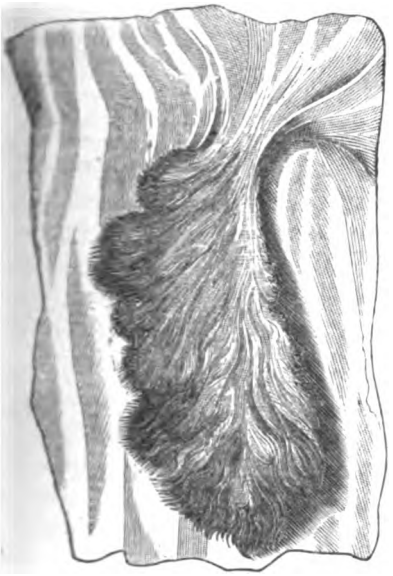
2. PROLAPSE OF THE RECTUM. This is a frequent disease of children. It is due, in children, to lack of tone in the muscular structure of the rectum, or to general debility. If present in adults, a relaxed condition of the sphincter exists.

   It may occasionally be produced by hemorrhoids and by urethral stricture as a result of straining.

3. FISTULA OF THE RECTUM. This condition may arise primarily by either ulceration of the rectum, or the formation of an abscess in the cellular tissue external to the rectum.

   Rectal fistulæ may be 1. *Complete*, where the rectal canal and the external opening communicate; 2. *Incomplete* or blind fistulæ, where one of these

PLATE XVIII.



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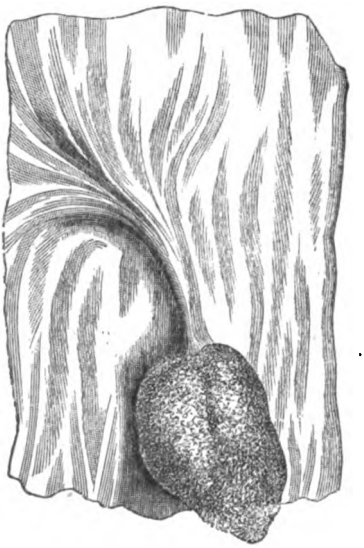

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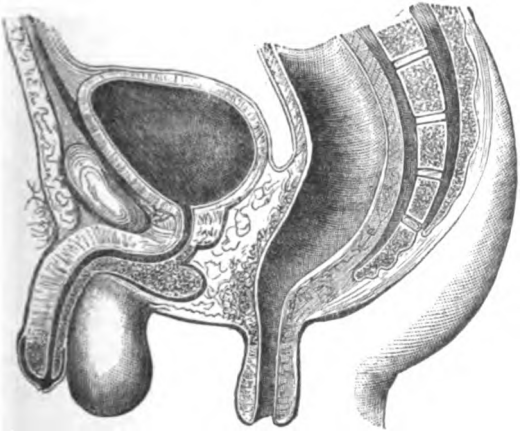

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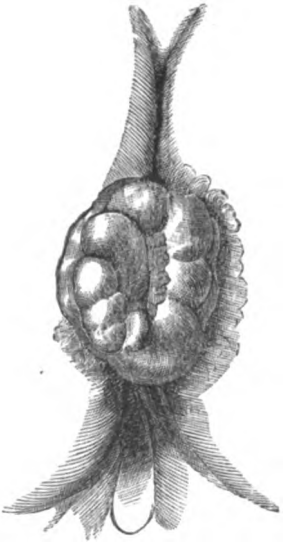


4

1 Rectal polypus. 2. Glandular rectal polypus. 3. Prolapse of the rectum in its first stage. 4. Internal hemorrhoids.

openings is absent. Fistulæ may vary in their number, situation, length and calibre. They are frequently associated with inflammatory induration of the neighboring tissues.

4. Ulcer or Fissure of the Anus. This condition may be either a true fissure, or a small, oval-shaped ulcer, located just within the anus. It produces the most intense suffering and can be detected only by a *careful* scrutiny of the parts, as it may be overlooked or concealed by the rugæ around the anal margin.

5. Stricture of the Rectum. Stricture of the rectum may involve the whole circumference of the gut, or only a portion of it.

   The *extent* of the bowel affected may vary from two lines to two inches, or even more.

   The *seat* of stricture may vary from one inch, to four or five inches above the anus.

   Stricture of the rectum may arise from cicatrices of formerly existing ulcers, from injuries, from surgical operations on the rectum, or from the pressure of tumors or organs. It is almost always associated with abscess and fistulæ, if of long duration.

6. Cancer of the Rectum. Scirrhus, epithelioma, and colloid cancer, are met with in the rectum. They usually are first recognized as a hardened or indurated mass in the walls of the bowel causing diminution in its calibre. Cancer in this locality usually results in death within four years from the date of its commencement.

   A marked cachexia becomes apparent as the disease develops.

7. Rectal Polypus. Polypi of the rectum may be of three types: 1, vascular polypi; 2, warty polypi; and 3, fibro-cellular polypi.

   Of these, the first is most frequent among children, and is usually associated with hemorrhage; while the other two are comparatively non-vascular. They are all markedly pediculated, and are much less painful than hemorrhoids.

8. Pruritus Ani. This distressing affection may result

from constipation, abnormal intestinal secretion, ascarides in the rectum, prolonged sitting posture, and uterine diseases. It is usually associated with morbid textural changes around the anus, if long continued, from the irritation of scratching.

9. NEURALGIA OF THE RECTUM. This condition is diagnosed by a severe and continuous pain within the rectum, not markedly affected by the condition of the bowel or attempts at defecation, and associated with no appreciable rectal disease. It occurs most frequently in females who have been in a state of depressed vitality.

The symptoms of the following conditions of the rectum, viz. hemorrhoids, fistulæ, fissure of the anus, cancer, rectal polypi and rectal prolapse, will be found contrasted in diagnostic tables at the close of this chapter on surgical diseases of the abdomen.

D.

HERNIA.

By the term hernia, is meant "a protrusion of any viscus from its natural or containing cavity."

Hernia may be classified, first, on a basis of the ANATOMICAL LOCATION of the protruding viscus, as follows:

- HERNIA: Classified on a basis of *location*.
  - In the cranial region. → HERNIA CEREBRI.
  - In the thoracic region. → HERNIA OF THE LUNG.
  - In the epigastrium. → DIAPHRAGMATIC HERNIA. / EPIGASTRIC HERNIA.
  - In the mesogastrium.
    - VENTRAL HERNIA.
    - UMBILICAL HERNIA. ..... → OMPHALOCELE—EXOMPHALOS.
    - LUMBAR HERNIA.
  - In the hypogastrium.
    - Above *Poupart's ligament*. → INGUINAL HERNIA. / INGUINO-SCROTAL HERNIA. / INGUINO-LABIAL HERNIA.
    - Below *Poupart's ligament*. → FEMORAL HERNIA. MERCELE.
    - Through *pelvic apertures* or in the pelvic region.
      - OBTURATOR HERNIA.
      - PERINEAL "
      - PUDENDAL "
      - VAGINAL "
      - ISCHIATIC "

Hernia may be classified, secondly, on a basis of the CONTENTS OF THE SAC:

HERNIA: Classified on a basis of *contents:*

of Intestines.	ENTEROCELE.
of Omentum.	EPIPLOCELE.
of Intestines and Omentum.	ENTERO-EPIPLOCELE.
of Bladder.	CYSTOCELE.
of Rectum.	RECTOCELE.
of other organs.	HERNIA CEREBRI. " OF LUNG. " " LIVER. " " SPLEEN. " " KIDNEY. " " STOMACH. " " TESTIS.

Hernia may be classified, thirdly, on a basis of the CONDITION OF THE SAC, as follows:

HERNIA: Classified on a basis of the *condition* of the sac:

REDUCIBLE HERNIA.	Where the protruded viscus and its coverings can be replaced in their normal situation.
IRREDUCIBLE HERNIA.	Where the protruded viscus is retained in its abnormal position by adhesions, thickening of its coverings, or a deposit of fat.
STRANGULATED HERNIA.	Where the *circulation* of the displaced viscus is impaired by muscular spasm, œdema, or a sudden forcing of additional contents into the sac.
INCARCERATED HERNIA.	Where a hernial protrusion of intestine is rendered *temporarily* irreducible by gas or fæces.
INCOMPLETE HERNIA.	Where the hernial protrusion has not attained the development common to the region in which it exists.
CONGENITAL HERNIA.	Where a hernial protrusion follows the descended testicle before the cavity of the tunica vaginalis is closed, thus giving it one layer only of peritoneal covering.
INFANTILE HERNIA.	Where a hernial protrusion into the scrotum occurs *outside of*, but parallel to the serous coats of the tunica vaginalis. This condition is not always one of infancy, although so named.

Certain *special* types of hernia are also subdivided on grounds of the surgical relations of the neck of the sac, the direction of the means of exit, or the location of the tumor. Thus *inguinal hernia* in its different forms may be spoken of or described under the following names:

Nomenclature of Inguinal Hernia:

1. Indirect Hernia; by which term is meant that form of inguinal hernia which passes through both the internal and external abdominal rings.
2. Direct Hernia; by which term is included all forms of inguinal hernia which pass through the external ring but *escape the internal ring.*
3. External Hernia. This is a synonym for indirect inguinal hernia, the name being applied from the external relation of the neck of the sac to the *deep epigastric artery.*
4. Internal Hernia. This also is a synonym for direct inguinal hernia, since *in both* the neck of the sac lies *internally* to the epigastric artery.
5. Bubonocele. By this term is meant an incomplete indirect inguinal hernia. Its name is applied from its resemblance to an inflamed lymphatic gland in the groin (bubo).

Causes of Hernia of the Abdominal Viscera.

The conditions which may tend towards a protrusion of any of the abdominal viscera may be either *predisposing* or *exciting.* Under the first may be enumerated

Predisposing causes of Hernia:

A. Wounds or Lacerations of the Abdominal Walls. Hernial tumors of the liver, stomach, intestines, spleen and kidney, have been known to exist as a result of wounds of the abdominal parietes. The extent of the wound, its depth and location, tend greatly to modify its effect upon displacement of viscera.

Predisposing causes of Hernia: (*continued.*)

B. WEAKENING OR DESTRUCTION OF THE ABDOMINAL WALLS by *inflammation, ulceration, suppuration, or disease.* Hernial protrusions often follow abscess, severe types of ulceration and contusions of the abdominal walls, or when they are subjected to excessive strain, as in violent muscular efforts, prolonged attacks of coughing or sneezing, or in cases of straining during defecation.

C. THE EXISTENCE AT BIRTH AND PERSISTENCE AFTERWARDS OF A CANAL COMMUNICATING WITH THE PERITONEAL CAVITY. The prolongation of the peritoneal cavity, produced by the descent of the testicle, becomes in the majority of cases a separate sac, called the tunica vaginalis, by adhesion of its surfaces within the inguinal canal during the first month of life and often before birth. In rare cases however this union fails to occur.

D. A GRADUAL PROTRUSION OF THE ABDOMINAL WALLS INTO AN ABNORMAL RECEPTACLE FOR VISCERA. This condition we see manifested in cases of enormous double scrotal hernia. It occurs where a condition of relaxation of the abdominal muscles or a redundance of tissues exists to a marked degree.

E. SEX. Hernia as a disease affects males to a far greater extent than females. Still in the femoral and umbilical types of hernia the contrary holds good.

F. AGE. Hernia is most frequent in infancy, and is a common affection in youth. It is comparatively rare between the ages of 13 and 21; but as age advances the tendency to this affection steadily increases. In women hernia occurs most frequently from the ages of 20 to 50.

Predisposing causes of Hernia: (*continued.*)

- G. Height. Hernia occurs more often in tall than in short people, especially so if the general state of health is not robust.
- H. Occupation. Occupations demanding great muscular effort or intermitting strain upon endurance, tend greatly towards the formation of hernia, especially when aggravated by belts worn around the waist, which, by compressing the viscera of the abdomen, tend to assist in the production of their displacement.

The *exciting* causes of hernia usually consist of some violent muscular effort, under which head may be mentioned

Exciting causes of Hernia:

- A. Lifting of Heavy Weights.
- B. Violent Efforts in Jumping, Running, or Climbing.
- C. Severe Attacks of Coughing or Sneezing.
- D. Straining during Attempts at Micturition, when urethral stricture is present.
- E. Falls associated with Efforts to Recover Balance.

Symptoms of Hernia in General.

The symptoms, produced by hernial protrusions, vary with the anatomical situation of the tumor, and also with the portion of the body displaced and contained within the hernial sac. As the larger proportion of all hernial tumors is confined to the inguinal and femoral regions, the prominent symptoms pertaining chiefly to these will first be considered, and, subsequently, those referable to the other more important varieties.

1. *Sudden Appearance of an External Tumor.* This symptom is evident in all forms of inguinal, and in femoral hernia, since the coverings are superficially situated, and readily indicate the presence of any protrusion of viscera, by deviations from the normal contour of the affected part. If the hernia be complete, the tumor may attain a large size; but, if incomplete, careful inspection may

be required to perceive it. In *femoral* hernia, the tumor seldom attains extreme dimensions; but, if complete, it may reach the size of a hen's egg; while, in case of *inguinal* hernia, the scrotum may, in some instances, be distended to an immense size.

In the case of *cystocele*, *rectocele*, *gluteal*, *obturator*, *sciatic*, or *perineal* hernia, the external tumor may escape detection, if not carefully sought for; while the protrusion of *diaphragmatic* hernia can only be detected by the physical signs of local consolidation in the dependent portion of the chest and in the median line of the body.

In *cerebral* hernia, the protrusion of brain substance is usually self-evident, as is also the case in hernia of any of the thoracic or abdominal viscera, where the protrusion depends upon some laceration or destruction of the abdominal parietes.

2. *Character of the Tumor.* The sense of touch may often detect the character of the contents of hernial protrusions, since, if *soft* and *cushion-like* in feel, the presence of intestine and its inclosed air may be strongly suspected; while, if hard and more resistant to pressure, the protrusion of omentum may safely be diagnosed, if the hernia be situated in the inguinal or femoral regions.

Percussion is often of great value in further deciding upon the presence or absence of omentum, since a *dull note* will indicate the *solid character* of the contents, while *resonance* will indicate the inclosure of air.

Auscultation of the tumor, if it be dependent upon *protruded intestine*, may detect the presence of a *gurgling sound* as air enters and escapes from its cavity. This symptom, when present, is of great diagnostic value.

3. *Weight of the Tumor.* In cases where the scrotum is distended, the question of the *existence of fluid* within the cavity of the tunica vaginalis may often be decided alone upon the weight of the tumor, which will be much greater than if intestine and even some omentum be contained.

4. *Surface of the Tumor.* Hernial tumors are, as a rule, *smooth* and of regular outline, in contrast to some forms of new growths, where the outline is irregular and the surface more or less nodular.

This point is often of value in deciding between the possibility of some extraneous growth and a hernia of long standing, whose protrusion may be so slight as not to admit of a positive diagnosis without the exclusion of other abnormal conditions.

5. *Cough Impulse.* In the inguinal variety of hernia, if not *omental* in character, and often in femoral hernia, a peculiar impulse may be perceived within the tumor, if the hand of the surgeon

either grasps it or lies in contact with it, and the patient be requested to cough violently.

This symptom is valuable as a diagnostic sign of hernia, but is not infallible, since fluid communicating with the abdomen and protruding through its walls, as in the case of psoas abscess, will yield even a more forcible impulse than the air within a hernia, for the reason that fluid transmits vibrations more readily than any form of gas.

6. *Pain.* Hernial tumors may often be painless, provided the dragging sensation of weight, in case the tumor be of large size, be not considered as a form of pain. In the majority of instances, pain of a marked character is little complained of by patients afflicted with rupture.

Pain may, therefore, be properly considered as an evidence that the protrusion is either *inflamed*, or *constricted* by the surrounding tissues so as to impair the freedom of its circulation (the condition known as "strangulation").

With this pain comes also often *tenderness to touch*, and often a sensitiveness when motion is attempted. These symptoms should, therefore, never be considered trivial, or allowed to pass unnoticed, since, often, surgical relief is demanded, and, if too long delayed, this condition may result in the loss of the life of the patient.

7. *Condition of the Bowel.* Constipation is not a *necessary result* of hernia, even if the bowel be implicated and long retained in its abnormal position, but, should constipation be present, it often becomes a point of great diagnostic value in deciding upon the character of the tumor or upon the presence or absence of strangulation of the intestine.

As long as the bowel acts regularly and performs its proper functions, so long may we safely exclude serious consequences to the patient, even if the tumor be incapable of reduction.

8. *Reducibility.* Hernial tumors are usually reducible, if of recent origin. Not infrequently the recumbent position alone is sufficient to cause either the partial or entire disappearance of the tumor; and patients frequently experience relief during their sleeping hours, only to experience a return of the tumor on rising. In many cases, however, manipulation or "taxis" is required to restore the hernial protrusion; and, in cases of long standing, the reduction may be rendered impossible, since the coats composing the sac may have become adherent or thickened, or a deposit of fat may have occurred between the different layers of the sac, or even in the protruded omentum, or upon the coats of the intestine. This

condition of *irreducibility* is not to be confounded with that of *strangulation*, since the *circulation of the part* may still be unimpaired.

Congenital Hernia.

Although this form is confined to the inguinal region, it presents two points of diagnostic value, besides the ones previously given, as the symptoms of hernia in general. These special symptoms are (1) the presence of fluid which gravitates from the peritoneal cavity, and which may give both *fluctuation* and *translucency* to the tumor, and (2) a *reducibility of the testicle*, after the hernial protrusion has been replaced, in cases where the hernia has previously reached the scrotum.

It is most frequently present in the infant, and shows a marked tendency to recur, if not kept from again protruding, until the cavity of the tunica vaginalis is made to close by mechanical means.

Ventral Hernia.

This condition usually follows wounds, laceration, or abscess of the abdominal walls, and is rarely a congenital affection, or the acquired result of a strain or excessive exertion.

It may occur at any age and in any portion of the abdomen, though the anterior wall, near the median line, is its most frequent situation. It is usually an intestinal protrusion accompanied by more or less omentum. Its reduction is often more difficult than where the tumor has protruded through the inguinal or femoral canal, or the umbilicus.

In rare cases, the stomach and even the liver and spleen have been known to protrude through a rent in the abdominal walls.

Diaphragmatic Hernia.

This accident is rarely met with, since it is usually associated with rupture or laceration of some portion of the diaphragm. In some instances, however, a hernial protrusion may escape through some of the normal openings in the diaphragm, and, in rare cases, a protrusion may result from a lack of tone in the muscle, without either a dilatation of the normal openings or a laceration of the muscular fibres. It may follow a fall from a height, the passing of a heavy weight over the abdomen, or even forcible spasm of

the muscle, caused by a sudden slip or slight fall. Laceration of the muscle is usually accompanied by *pain* of an intense character, and by difficulty in walking and in respiration.

In case the rent in the diaphragm is extensive, it is usually accompanied by a displacement of the stomach, transverse colon, small intestine, or omentum, into the cavity of the chest, and, in some cases, with a rupture of these organs and an escape of their contents.

If such a protrusion exist, irrespective of the cause which produces it or the condition of the diaphragm which allows of the protrusion, the chest will usually be rendered prominent on the side where the organs are displaced; the heart may be pushed from its normal position, respiration may be rendered difficult, and the respiratory murmur may be absent over the seat of the protrusion. The percussion note over the tumor will be *resonant* if the escaped viscera contain air, or *flat* if a solid organ be displaced. Vomiting, of a constant character, will also generally be present. Death will usually follow, if the contents of the displaced organ have escaped into the thoracic cavity from a laceration in its tunics, as occurs often in case the stomach or intestine is protruded through the diaphragm; and it may also follow a simple displacement of an organ, even when no rupture has taken place, from a subsequent pleurisy, peritonitis, or strangulation of the part.

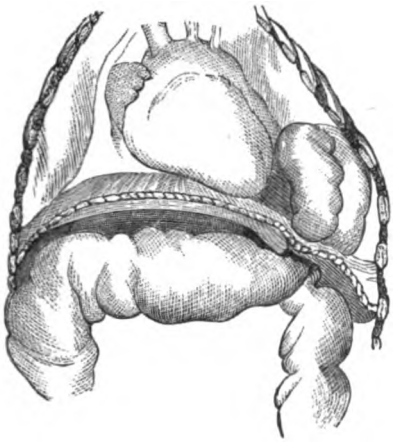
The points of diagnosis between diaphragmatic hernia and mediastinal tumors will be found contrasted in subsequent pages of this volume.

Differential Diagnosis of Hernia.

Hernia of the Inguinal Region may be confounded, as a disease, with the following named conditions:

1. Hydrocele of the Testicle.
2. Sarcocele " "
3. Varicocele.
4. Hæmatocele.
5. Bubo.
6. Undescended Testicle.
7. Impacted Fæces.
8. Hydrocele of the Cord.

PLATE XIX.



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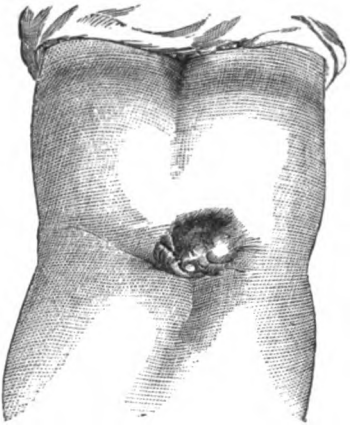

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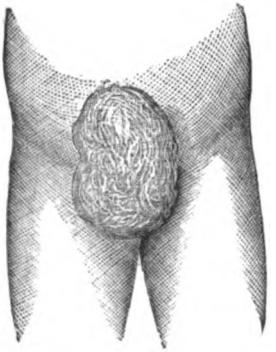

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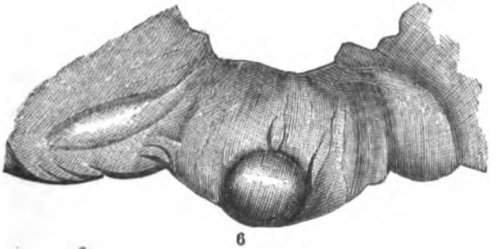

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1. Diaphragmatic hernia. 2. Spina bifida. 3. Irreducible umbilical hernia. 4. Congenital hernia. 5. Infantile inguinal hernia. 6. Loop of intestine from a strangulated inguinal hernia.

It is often difficult also to discriminate between the *inguinal* and *femoral* varieties of hernia, or to detect the various *special forms* of inguinal hernia from each other. In the diagnostic tables appended, I have endeavored, therefore, not only to exhibit the points of contrast between inguinal hernia and other surgical diseases confined to that locality of the body, but also to make clear the points of distinction between those various conditions of inguinal hernial protrusions, which are liable to be encountered in a surgical practice.

FEMORAL HERNIA may be confounded, in diagnosis, with many surgical conditions of the thigh, which often bear symptoms in common with that disease. Among these conditions leading towards error, may be enumerated as important

1. Enlarged Glands.
2. Psoas Abscess.
3. Varix of the Saphenous Vein.
4. Lipoma of the Femoral Canal.

I have added also, in the following pages, diagnostic tables between ventral and umbilical hernia, thyroid and perineal hernia, diaphragmatic hernia and mediastinal tumors, congenital and infantile hernia, and congenital hernia and hydrocele.

In connection with diseases of the rectum, which have been enumerated and described in preceding pages of this chapter, will be shown, in contrast, the symptoms of external and internal hemorrhoids, external hemorrhoids and condylomata of the anus, internal hemorrhoids and rectal polypi, rectal prolapse and rectal polypi, cancer and stricture of the rectum, fissure of the anus, and fistulæ of the rectum.

I have dwelt but slightly upon the *symptoms* of the diseases of the organs of the abdomen, as they will be found in full in the following pages. I have left unmentioned in these tables, also, contusion of the abdomen and its results (abscess and ecchymosis), as they have no special features over similar changes in other parts, and properly belong to the following chapter on diseases of tissues, in which they will be considered.

I have introduced, however, a table of diagnosis between *Typhlitis* and *Perityphlitis*, as it seems properly to belong to this chapter; and I have added, in connection with it, a table of the causes and symptoms of *intestinal obstruction*.

TYPHLITIS.	PERITYPHLITIS.
DEFINITION.	
Is an inflammation of the cæcum and its vermiform appendix.	Is an inflammation of the connective tissue about the cæcum.
HISTORY.	
The appearance of a tumor in the right iliac fossa is preceded by *colicky pains* and *distension of the abdomen* from tympanites.	No early diagnostic symptoms precede the attack. It occurs from traumatism, ulceration of the vermiform appendix, pyæmia, etc.
PAIN.	
The pain is *superficial* and is confined to the right iliac fossa and right hip.	The pain is deep-seated in the right iliac fossa.
NUMBNESS.	
No numbness is felt in the right thigh and leg.	A sense of numbness is present often in the right lower extremity.
EFFECT OF MOTION.	
Motion of the thigh produces pain only in the later stages.	Motion of the thigh produces pain early in the disease.
TUMOR.	
The tumor is sausage-shaped and superficial.	The tumor is deeply located and fluctuates in the advanced stages.
PERCUSSION.	
Flatness is present over the tumor.	Tympanitic percussion, from the inflated cæcum, exists over the tumor, if uncomplicated.
CONTROL OF THIGH.	
The patient can raise the right thigh.	The patient cannot raise the right thigh, as a rule.
ABSCESS.	
Suppuration and pointing are rarely, if ever, present.	Suppuration, and pointing, as a rule exist, if the abscess is to open externally.

INTESTINAL OBSTRUCTION.

Intestinal Obstruction. (2 varieties.)

- **If of sudden origin it may be due to**
  1. Foreign bodies.
  2. Twisting of the intestine.
  3. Intussusception of the bowel.
  4. Congenital stricture of the bowel.
  5. Congenital malformation of the bowel.
  6. Strangulation of the bowel by bands of lymph.
  7. Strangulated hernia.
  8. Entanglement of bowel with mesentery or omentum.
- **If of *slow* development, it may result from**
  1. Malignant disease.
  2. Impaction of fæces.
  3. Abnormal concretions.
  4. Pressure of tumors, abscess, etc.
  5. Tubercular peritonitis.

SYMPTOMS IN COMMON.

A *tumor* is usually detected in the abdomen. When due to impaction of fæces, this tumor *indents* on firm pressure.

Pain is usually a marked symptom; it is local, as a rule, and deep-seated.

Dulness on percussion exists often over the seat of pain, in case a tumor cannot be detected.

Obstinate constipation exists, which withstands all attempts at removal.

Vomiting is a marked symptom. When *stercoraceous* in character, it is a pathognomonic symptom. If occurring late in the attack it often indicates an obstruction low down in the bowel.

Distension of the abdomen from tympanites. This condition is very marked when the *large* intestine is obstructed, but much less so if the *small* intestine be the seat of disease.

Visible peristalsis is often present, especially in those cases of sudden origin.

EXTERNAL HEMORRHOIDS.	INTERNAL HEMORRHOIDS.
Appearance of Tumor.	
The tumor is smooth on its surface.	The tumor has often a granular surface.
The tumor is partially covered with integument.	The tumor is entirely covered with mucous membrane.
The tumor is seldom pediculated.	The tumor is usually pediculated.
Situation.	
The tumor is always situated at the margin of the anus.	The tumor is attached to the walls of the rectum.
Reducibility.	
The tumor always presents externally, but may often be evacuated by pressure or position.	The tumor can be replaced within the rectum and may remain replaced for days, weeks, or months.
Density.	
The tumor is firm in its texture.	The tumor is soft and often friable.
Hemorrhage.	
Hemorrhage is infrequent and seldom severe in amount.	Hemorrhage often becomes excessive and is of frequent occurrence.
Pain.	
The pain is usually local and confined to the tumor.	The pain is often conveyed to neighboring regions.
The pain is usually of moderate severity and is often absent.	The pain is severe, as a rule, in case the tumor becomes externally apparent.

EXTERNAL HEMORRHOIDS.	CONDYLOMATA OF THE ANUS.
Surface of Tumor.	
The surface of the tumor is smooth.	The surface of the excrescences is of a warty appearance, resembling that of a strawberry.
Number.	
A solitary tumor is not uncommon.	The tumors are *multiple*, as a rule, with deep clefts between them.
Shape.	
The tumors are round or oval.	The tumors are flat and broad.
Development.	
The development of the tumors is often very rapid.	The development of condylomata is usually slow.
Discharge.	
No discharge is present.	A profuse and irritating discharge exists.
History.	
No venereal history is detected as a cause.	A venereal history often exists as a cause.
Effects of the Condition of the Bowel.	
The tumor is often affected in its size and appearance by the condition of the bowel or causes affecting the portal circulation.	The tumors are independent of changes in the circulation of the rectum or liver.

INTERNAL HEMORRHOIDS.	RECTAL POLYPUS.
NUMBER OF TUMORS.	
The tumors are usually multiple.	A solitary tumor is most commonly present.
SIZE OF TUMORS.	
The tumor is generally small.	The tumor is usually large.
PEDICULATION.	
The pedicle is indistinct or absent.	The pedicle is marked.
RAPIDITY OF GROWTH.	
Hemorrhoids often form with great rapidity.	Polypus is usually of slow growth.
COLOR.	
Hemorrhoids are usually of a violet color.	The tumor is pale in color.
SURFACE.	
The tumors are granular on their surface.	The surface of the tumor is smooth.
AGE AFFECTED.	
The young are rarely, if ever, affected.	The young are frequently affected.
EFFECTS OF CONSTIPATION.	
The condition of the bowels exerts a marked influence upon the size of the tumors.	The size of rectal polypi is not affected by the condition of the bowels.
HEMORRHAGE.	
Hemorrhage is frequent and often severe.	Hemorrhage is infrequent, save when the vascular form of polypus is present.

RECTAL PROLAPSE.	RECTAL POLYPUS.
TUMOR.	
The tumor is continuous all around the circumference of the rectum.	The tumor is located upon one side of the rectum.
PEDICLE.	
No pedicle to the protrusion can be detected.	A pedicle is always easily detected.
STATE OF HEALTH.	
This condition is most common in children with enfeebled constitutions.	Occurs generally in healthy subjects.
HEMORRHAGE.	
Hemorrhage is frequent but is moderate in its severity.	Hemorrhage is infrequent, save when the polypus is of the vascular variety.

SYMPTOMS IN COMMON.

Both occur chiefly in the young.
" are reducible within the bowel.
" are not severely painful unless retained after protrusion.
" are pale in color.
" painless to direct touch.
" sensitive to traction upon them.

CANCER OF THE RECTUM. STRICTURE OF THE RECTUM

AGE AFFECTED.

Is rare in the young, but is common in advanced life.	May affect any age.

LOCATION AND CHARACTER.

It may be detected as a uniform infiltration around the rectum, or as nodular masses in its walls. It is common near the anus, and its surface is often friable.	The constriction is usually annular in character, and is seldom unilateral. It is most frequently detected about two inches from the anus, and it presents no abnormal condition of surface.

DEFECATION.

Defecation becomes difficult *early*, even before marked constriction exists, from loss of contractile power in the rectum.	Defecation becomes difficult *late* in the disease, as the rectal walls are normal in power.

PAIN.

A *violent burning*, or *boring* pain is present on defecation and often long after its completion.	Pain is often absent.

ABNORMAL SENSATIONS.

A sensation of a *foreign body* in the rectum is present.	No abnormal sensations exist in many typical cases.

HEALTH.

The general health is rapidly undermined.	The general health is *slowly* affected—if much altered.

DISCHARGE.

A slimy, fœtid, and often sanious discharge from the bowel exists.	No discharge is present, if ulceration of the bowel does not exist as a complication.

SYMPTOMS IN COMMON.

Both are associated with interference with defecation.
" " " " diminished rectal calibre.
" " " " tympanitic distension of abdomen in advanced stages.

FISSURE OF THE ANUS. FISTULA OF THE RECTUM.

History.

Occurs most often in females, debilitated subjects, or in syphilis.	Occurs most often in men, and is preceded by a history of abscess.

Pain.

The pain is *burning* in character. " " exacerbates often during menstruation. " " is augmented by defecation. " " is often constant. " " is frequently not local but radiates to pelvis, back, thighs, etc., etc.	Pain is often absent and, if present, is not severe in type. A sense of moisture and itching is however present from the excoriation due to the discharge.

Sphincter of Anus.

The sphincter is spasmodically contracted. The finger, if introduced into the rectum, causes great pain.	The sphincter ani muscle is not affected. The bowel can be easily and painlessly explored.

Urinary Symptoms.

Retention of urine, painful micturition and other urinary symptoms of a reflex character are common.	Reflex urinary symptoms are seldom produced.

Inspection.

A fissure or a small ulcer can be detected at the margin of the anus, if carefully looked for, as it is often concealed by the rugæ.	Inspection of the perineum reveals either a papilla at the seat of the external opening of the fistula, or an orifice, which is often concealed by folds of the skin.

Discharge.

No abnormal discharge from the fissure or ulcer occurs, sufficient to cause annoyance or notice.	A purulent or fæcal discharge exists, causing irritation of the parts, staining the clothing, and generally having an offensive odor.

INDIRECT INGUINAL HERNIA.	DIRECT INGUINAL HERN
SIZE OF TUMOR.	
The tumor is often very large.	The tumor is usually small in
SHAPE OF TUMOR.	
The tumor is usually flask-shaped.	The tumor is usually globular
LOCATION.	
The tumor is frequently scrotal.	The tumor is seldom scrotal.
PALPATION.	
The tumor is usually an enterocele, and is therefore *soft* and *doughy* to the touch.	The tumor is usually omen and is therefore hard.
PERCUSSION.	
Resonant percussion usually exists over the tumor.	Flatness on percussion over th tumor is frequent.
INGUINAL CANAL.	
The inguinal canal is filled.	The inguinal canal is empty.
SPERMATIC CORD.	
The spermatic cord usually lies concealed *behind* the neck of the sac.	The spermatic cord can be detected at the *outside* of the neck, as a rule.
EPIGASTRIC ARTERY.	
The pulsation of the deep epigastric artery is concealed.	The epigastric artery can be often felt to pulsate *outside* of the neck of the tumor.
REDUCTION.	
The tumor is reduced by pressure *outwards* and *backwards*.	The tumor is reduced by pressure directly *backwards*.

SYMPTOMS IN COMMON.

Both are associated with a sudden advent.
" " " " an impulse on coughing.
" " " " reducibility, as a rule.
" " " " possible intestinal embarrassment.

SCROTAL HERNIA.	SARCOCELE.
PALPATION.	
The tumor is soft and doughy to touch.	The tumor is usually hard and resistant.
WEIGHT.	
The tumor is light.	The tumor is heavy.
SURFACE.	
The tumor is smooth and regular.	The tumor is often nodular and irregular in outline.
PAIN.	
The tumor is seldom painful, unless inflamed or strangulated.	The tumor is frequently painful.
DEVELOPMENT.	
The tumor is of sudden advent.	The tumor grows slowly, as a rule.
PERCUSSION.	
The percussion note over the tumor is usually resonant.	The percussion note over the tumor is usually dull or flat.
INGUINAL CANAL.	
The inguinal canal is usually filled.	The inguinal canal is empty.
COUGH IMPULSE.	
An impulse on coughing is present in the majority of cases.	No impulse on coughing can be detected.
BOWEL.	
The bowel is occasionally embarrassed.	The bowel is never affected.
REDUCTION.	
Reduction is accomplished by pressure *backwards* and *outwards*, unless the hernia is strangulated, incarcerated, or irreducible.	The tumor is irreducible.
AUSCULTATION.	
Gurgling may be detected.	No auscultatory sounds are present.

SCROTAL HERNIA.	HYDROCELE OF TESTICL
SHAPE OF TUMOR.	
The tumor is usually flask-shaped.	The tumor is pyriform or ov
DEVELOPMENT.	
The tumor is usually of sudden advent; and develops from above downwards.	Develops slowly from below wards.
PALPATION.	
The tumor is soft and doughy to the touch, as a rule.	The tumor is hard, tense a *elastic.*
FLUCTUATION.	
Fluctuation is absent.	Fluctuation is well marked.
TRANSLUCENCY.	
The tumor is opaque.	The tumor is translucent.
PERCUSSION.	
Resonant percussion is usually present over the tumor.	The percussion note over the tumor is dull or flat.
REDUCIBILITY.	
The tumor is usually reducible.	The tumor is never reducible.
SPERMATIC CORD.	
The spermatic cord is usually concealed by the neck of tumor.	The spermatic cord is neither concealed nor displaced.
INGUINAL CANAL.	
The inguinal canal is filled, save when direct hernia enters the scrotum.	The inguinal canal is empty.
ASPIRATOR.	
The effects of aspiration are negative.	Fluid is withdrawn by aspiration or tapping.
BOWEL.	
The action of the bowel may be embarrassed.	The action of the bowel is unaffected.

SCROTAL HERNIA.	VARICOCELE.
PALPATION.	
The tumor is usually smooth on its surface and regular in its outline.	The tumor is knotty and irregular and feels like "a bag of worms."
COLOR OF TUMOR.	
The tumor is of normal color.	The tumor is bluish.
LOCATION.	
May exist on either side.	Most frequent on the left side.
EFFECT OF HEAT.	
Negative.	Tumor increases on the application of heat.
DEVELOPMENT.	
The tumor develops suddenly.	The development of the tumor is gradual.
PERCUSSION.	
The percussion note is usually resonant.	The percussion note is dull.
FLUCTUATION.	
Fluctuation never exists.	Fluctuation may exist if the vessels be very large.
SPERMATIC CORD.	
The spermatic cord is concealed or displaced.	The spermatic cord is not affected.
INGUINAL CANAL.	
The inguinal canal is usually filled.	The inguinal canal is uninvolved.
COUGH IMPULSE.	
A cough impulse is usually detected.	No impulse on coughing exists.
REDUCTION.	
Reduction is accomplished usually by taxis only.	Reduces often spontaneously by any position favoring increased venous return.
RETURN OF TUMOR.	
The tumor, if once reduced, can be prevented from a return by pressure at the external ring.	The tumor returns when the patient stands up, in spite of pressure at the ring.
SENSATION IN SCROTUM.	
There is a sense of distension only, unless inflammation or strangulation exist.	A sense of weight, and of constant dragging in the scrotum, exists.

SCROTAL HERNIA.	HÆMATOCELE OF TESTIS.
ADVENT.	
The advent of the tumor is sudden, and it grows from *above*, downwards.	The advent is sudden, if of traumatic origin; but if of spontaneous origin, the tumor may develop slowly. It grows from *below*, upwards.
FLUCTUATION.	
Fluctuation is never present.	Fluctuation is always present until coagulation occurs.
PALPATION.	
The tumor is soft and doughy.	The tumor is soft at first, but hard after coagulation occurs.
SHAPE.	
The tumor is flask-shaped, unless due to direct hernia.	The tumor is pyriform in its shape.
INTEGUMENT.	
Normal in color.	Ecchymotic.
REDUCIBILITY.	
The tumor is usually reducible.	The tumor is irreducible.
PERCUSSION AND AUSCULTATION.	
Percussion is usually resonant; gurgling may be also heard.	Percussion is dull or flat. Auscultation negative.
WEIGHT OF TUMOR.	
The tumor is light in weight.	The tumor is heavy.
SPERMATIC CORD.	
The spermatic cord is concealed or displaced.	The spermatic cord is unaffected.
INGUINAL CANAL.	
The inguinal canal is usually filled.	The inguinal canal is empty.
CONSTITUTIONAL SYMPTOMS.	
None, save when strangulation, or severe inflammation of the sac exists.	Pallor and great prostration are often present from the loss of blood.
BOWELS.	
The action of the bowel may be embarrassed.	The bowels are unaffected.

INCOMPLETE INGUINAL HERNIA.	BUBO.
PAIN.	
The tumor is generally painless.	The tumor is usually painful.
PALPATION.	
The tumor is usually soft.	The tumor is hard, at the onset.
FLUCTUATION.	
Fluctuation is absent.	Fluctuation is present if suppuration occurs
LOCALITY.	
The tumor is confined to limits of inguinal canal.	The tumor is often diffused beyond the limits of the inguinal canal.
REDUCIBILITY.	
Reduction is possible and often easy.	Reduction is impossible.
OUTLINE OF TUMOR.	
The outline of the tumor is often indistinct.	The outline of the tumor is usually clearly defined.
ŒDEMA.	
Œdema is absent, as a rule.	Œdema is present, as a rule.
PERCUSSION.	
Frequently resonant percussion exists.	Dull percussion exists over the tumor.
COUGH IMPULSE.	
A cough impulse is often detected.	A cough impulse is usually absent.
HISTORY.	
A history of muscular strain is usually present.	A venereal origin is often detected.
BOWEL.	
The bowel may be embarrassed in its action.	The bowel is unaffected.
CONSTITUTIONAL SYMPTOMS.	
Absent, unless strangulation, or inflammation of the sac, occurs.	Frequent constitutional symptoms occur.
AUSCULTATION.	
Gurgling may be detected.	No gurgle will be heard.

BUBONOCELE.	UNDESCENDED TESTICLE.
PAIN.	
The tumor is usually painless.	The tumor is very painful, and on pressure over it yields the peculiar sickening sensation which is characteristic of compression of the testicle.
SCROTUM.	
Both testicles are present.	The testicle is found wanting upon the side corresponding to the tumor.
The scrotum is normal in development.	The scrotum is imperfectly developed on the same side.
REDUCTION.	
Reduction of the tumor is associated with a gurgle.	Reduction may be impossible, but if not so, no gurgle accompanies its return to the abdomen.
BOWEL.	
The action of the bowel may be embarrassed.	The bowel is unaffected.

SYMPTOMS IN COMMON.

Both are associated with a *small* tumor.
" " " " frequent reducibility.
" may be " " sudden advent.
" " " " impulse on coughing.
" " " " vomiting.

INGUINAL HERNIA.	IMPACTION OF FÆCES.
LOCATION OF TUMOR.	
The tumor is felt only in the inguinal region.	The tumor may be felt at the *side*, as well as in the inguinal region.
DEVELOPMENT.	
The tumor develops suddenly after some strain or injury.	The tumor develops slowly with previous colicky pains and from no apparent causation.
PERCUSSION.	
The percussion note is usually resonant.	The percussion note over the tumor is flat.
EFFECTS OF PRESSURE.	
Pressure causes no permanent change in the tumor unless it effects reduction.	Firm localized pressure over the tumor causes *indentation*.
SENSITIVENESS.	
The tumor is not sensitive unless inflamed or strangulated.	The tumor is *always* tender on pressure in its advanced stages.
PAIN.	
The tumor is usually *painless*.	The tumor is painful.
BOWEL.	
The bowel *may* be unaffected.	*Obstinate constipation* always exists.
VOMITING.	
Vomiting is absent if the hernia be not inflamed or strangulated.	Vomiting is usually present.

SYMPTOMS IN COMMON.

Both are associated with a tumor.
" may be associated with obstinate constipation.

INGUINAL HERNIA.	HYDROCELE OF THE CORD.
Limits of Tumor.	
The tumor is frequently scrotal, and is generally diffused.	The tumor is circumscribed.
Palpation.	
The tumor is soft, as a rule.	The tumor is tense.
Reducibility.	
The tumor reduces with a gurgle.	The tumor is usually irreducible, but if not so no gurgle is present on its reduction.
Translucency.	
The tumor is opaque.	The tumor is often translucent.
Fluctuation.	
The tumor does not fluctuate.	The tumor is fluctuant.
Percussion.	
The percussion note is resonant over the tumor, as a rule.	The percussion note is dull over the tumor.
Bowel.	
Intestinal embarrassment is often present.	No intestinal embarrassment exists.
Impulse from Testicle.	
Movements of the testicle have no effect upon the tumor.	The testicle, if moved, transmits an impulse to the tumor.
Cough Impulse.	
An impulse on coughing is frequently felt in the tumor.	Impulse on coughing is absent.
Auscultation.	
Gurgling is often heard in the tumor.	No gurgling is detected.
Return of the Reduction.	
The tumor remains reduced if the dorsal position is maintained.	The tumor returns after reduction irrespective of position.

FEMORAL HERNIA.	ENLARGED GLANDS.
DEPTH OF TUMOR.	
The tumor is often felt deep in the groin.	The tumor is always superficial.
MOBILITY OF TUMOR.	
The movements of the tumor are restricted.	The tumor exhibits great mobility.
REDUCIBILITY.	
The tumor is reducible by pressure downwards, backwards and upwards.	The tumor is not reducible.
NUMBER OF TUMORS.	
The tumor is always solitary.	The tumor is seldom solitary.
FLUCTUATION.	
Fluctuation is never present.	Fluctuation is often detected within the tumor.
BOWEL.	
Intestinal embarrassment is often present.	No intestinal embarrassment is produced.
COUGH IMPULSE.	
An impulse on coughing may often be detected on flexion and adduction of the thigh, with the body bent forwards.	No impulse on coughing is detected.
AUSCULTATION.	
Gurgling within the tumor is sometimes heard.	No gurgling is ever perceived in the tumor.
HISTORY.	
Is usually due to some severe muscular effort.	A scrofulous diathesis is often present.
PERCUSSION.	
Resonant percussion *may* exist over the tumor, in some cases.	The percussion note over the tumor is flat.
SEX.	
Is rare in the male sex.	Is equally frequent in both sexes.

FEMORAL HERNIA.	PSOAS ABSCESS.
FLUCTUATION.	
The tumor never fluctuates.	The tumor often fluctuates, if superficial.
PERCUSSION.	
The percussion note over the tumor may be resonant.	The tumor always yields a dull or flat percussion note.
RELATION OF FEMORAL VESSELS.	
The neck of the sac lies *internal* to the femoral artery.	The neck of the sac lies *external* to the femoral artery.
PAIN.	
Pain is frequently absent.	A pain in the back or loins has always *preceded* the development of the tumor.
GENERAL HEALTH.	
The general health is often normal.	The health is impaired.
HISTORY.	
A severe muscular effort usually precedes the advent of the tumor.	A history of spinal disease or of pelvic affection exists.
BOWEL.	
Intestinal derangement is often produced.	The bowel acts normally.
REDUCIBILITY.	
Reduction occurs with a distinct and *sudden* disappearance of the tumor, usually with a gurgle.	The tumor disappears *gradually* under direct pressure, but no gurgle is perceived.
The reduction requires pressure *downwards, backwards* and *upwards.*	No absolute direction of pressure is required.
RETURN OF TUMOR.	
The hernia remains reduced if the dorsal position is maintained.	The tumor returns as soon as the pressure is removed.

FEMORAL HERNIA.	VARIX OF SAPHENOUS VEIN.
SIZE AND DIRECTION OF TUMOR.	
The tumor is usually *small*, and is directed *obliquely across thigh.*	The tumor is variable in size, and lies in the *longitudinal axis* of the limb.
PALPATION.	
The tumor is usually *hard* and tense, but may be doughy.	The tumor is soft and often indistinctly fluctuant.
EFFECT OF HEAT.	
The tumor is not affected by heat.	The tumor is *increased* in size by heat.
SEX.	
The tumor is most frequent in females.	Is equally common in both sexes.
PERCUSSION.	
Resonant percussion often exists.	Flatness on percussion is present over tumor.
REDUCIBILITY.	
Reduces with a sudden *slip* and a gurgle.	Reduces gradually without any gurgle.
Is reduced by pressure directed *downwards, backwards* and *upwards.*	Is reduced by direct pressure and a recumbent position.
RETURN AFTER REDUCTION.	
The return is prevented when the patient is allowed to stand up, by pressure over the femoral ring.	The tumor returns when the patient stands, in spite of pressure on the femoral ring.
BOWEL.	
Intestinal embarrassment is not infrequent.	No embarrassment of the function of the bowel is ever produced.
SKIN.	
The skin is normal in color.	The skin is often discolored over tumor.
COUGH IMPULSE.	
May be detected by *flexion* and *adduction* of the thigh, with the *body bent forwards.*	Is often absent but may exist.

FEMORAL HERNIA.	INGUINAL HERNIA.
Sex Affected.	
Is most common in females.	Is most frequent in males.
Size of Tumor.	
Is usually a small tumor.	Is often very large.
Shape of Tumor.	
Is usually round, or, if elongated, lies obliquely across the thigh.	Is flask-shaped and, if elongated, is often scrotal in its situation.
Percussion.	
The tumor gives *frequently* a dull note on percussion.	Resonant percussion is usually present.
Location of Neck of Sac.	
The neck is felt below Poupart's ligament.	The neck lies above Poupart's ligament.
Relation of Spermatic Cord.	
The cord is felt *internal* and *in front* of the neck of the sac.	The cord is felt *external to*, and *behind* the neck of the sac.
Scrotum and Labia.	
The tumor never enters the scrotum or the labia.	The tumor often enters the scrotum and the labia.
Femoral Pulsation.	
Femoral pulsation can be felt *external* to the neck of the tumor when the finger is introduced into the canal.	The finger when pushed into the canal of the tumor fails to detect any pulsation.
Spine of the Pubes.	
The spine of the pubes can be felt to lie *internal* to the neck of the sac.	The spine of the pubes can be detected *externally* to the neck of the sac.

FEMORAL HERNIA.	LIPOMA OF FEMORAL CANAL.
DENSITY OF TUMOR.	
The tumor is often hard.	The tumor is always *doughy* to the touch.
OUTLINE OF TUMOR.	
The tumor is small and well defined in its outline.	The tumor is not well defined in its outline.
PERCUSSION.	
Resonant percussion may exist over the tumor.	The tumor yields a dull percussion note.
ADVENT.	
The tumor usually appears suddenly.	The tumor develops slowly.
REDUCIBILITY.	
The tumor is usually reducible.	The tumor is irreducible.
COUGH IMPULSE.	
An impulse on coughing can often be detected by flexion and adduction of the thigh, with the body bent forwards.	An impulse is never present within the tumor, on coughing.
BOWEL.	
Intestinal embarrassment is not infrequent.	The bowel is not affected.

SYMPTOMS IN COMMON.

Both are associated with a tumor in the upper part of the thigh.
" " " " " inside of the femoral vessels.
" " " " " external to the pubic spine.
" " " " " below the spine of the pubes.

VENTRAL HERNIA.	UMBILICAL HERNIA (OMPHALOCELE; EXOMPHALOS).
ADVENT.	
The tumor is never congenital.	The tumor is often congenital.
AGE.	
The tumor may occur at any age.	The tumor is frequent in infants.
APPEARANCE OF TUMOR.	
The tumor has a well-defined *neck*.	The tumor usually has no apparent neck, but consists of a simple bulging at the navel, which is usually spherical in its outline.
NAVEL.	
The navel is present and in its normal situation.	The navel is absent, as the tumor supplies its place.
PALPATION.	
The edges of an opening or fissure in the abdominal walls can often be detected.	No unnatural opening can be detected.
REDUCIBILITY.	
Reduction of the protrusion is often somewhat difficult.	Reduction is effected by mere pressure upon the protrusion.
HISTORY.	
A previous history of traumatism, abscess, or weakening of the abdominal walls, is present.	The history of traumatism or abscess is seldom present.

THYROID HERNIA.	PERINEAL HERNIA.
Sex Affected.	
The tumor seldom occurs in the male sex; when small it may often be impossible to detect its presence.	Is a rare disease; but it affects both sexes equally, and is easily detected when present.
Location.	
A tumor appears in the thigh near the inferior commissure of the vulva.	A tumor appears in the perineum above the rectum.
Neck of Tumor.	
The neck of the tumor can be felt from the outside of the body, in the old and the emaciated. In obscure cases a vaginal or rectal exploration is often required to detect the situation of the neck of the tumor.	A neck to the tumor is not discernible, unless the protrusion is very extensive and involves the perineum. The question of origin is, however, easily decided if the tumor be pronounced.

SYMPTOMS IN COMMON.

Both are associated with a tumor of sudden advent.
" " " " resonant percussion.
" " " " reducibility.
" " " " impulse on coughing, as a rule.
" " " " possible intestinal embarrassment.

DIAPHRAGMATIC HERNIA.	MEDIASTINAL TUMORS.
PERCUSSION.	
Tympanitic percussion, or a localized dulness *low* down in the mediastinum or thorax is present, if a hernial protrusion occurs through the diaphragm and is superficial.	Mediastinal tumors are usually situated *high up* in the thorax, as shown by a localized *dulness* on percussion.
AUSCULTATION.	
A gurgling sound is often heard over the seat of the tumor.	No auscultatory signs exist, except in case of aneurism, when a bruit will be detected.
ADVENT.	
The patient is conscious of the sudden advent of the protrusion into the thorax.	The tumor develops without any marked or sudden symptoms till its size creates pressure.
BOWEL.	
Intestinal embarrassment is liable to exist.	The bowel is unaffected.
THIRST.	
Extreme thirst is liable to be present.	Extreme thirst is absent.
PERITONITIS.	
Symptoms of peritonitis occur rapidly after the appearance of the tumor, if it be strangulated.	No peritoneal symptoms are ever produced.

CONGENITAL HERNIA.	HYDROCELE.
AGE AFFECTED.	
Is usually a disease of infant life; but, if once present, subsequent attacks in adult life may occur.	May affect any age; and, if in adults, is not necessarily associated with a history of a previous attack.
FLUCTUATION.	
The tumor is usually fluctuant at its *upper* portion as the peritoneal effusion gravitates into the sac.	The tumor is markedly fluctuant in all of its localities.
TRANSLUCENCY.	
The tumor *may* be translucent.	The tumor is *always* translucent.
PEDICLE.	
The tumor has a marked pedicle.	The tumor is not pediculated.
SHAPE OF TUMOR.	
The tumor is globular.	The tumor is pyriform.
DEVELOPMENT.	
The tumor *may* be of sudden occurrence, or may show sudden and rapid increase in its size when once developed.	The tumor always develops *slowly* and gradually.
INGUINAL CANAL.	
The inguinal canal is either distended or involved.	The inguinal canal is empty.
REDUCIBILITY.	
The fluid portion, when reduced by taxis or pressure, leaves a previously concealed testicle which also reduces with a marked gurgle and occasions a peculiar *sickening sensation* during its passage through the inguinal canal.	The tumor cannot be reduced.

CONGENITAL HERNIA.	INFANTILE HERNIA.
ADVENT.	
Occurs before the cavity of the tunica vaginalis has closed after the descent of the testicle.	Occurs after the closure of the tunica vaginalis.
FLUCTUATION.	
Fluctuation exists at the upper portion of the tumor from gravitation of the peritoneal fluid into the sac.	Fluctuation is absent.
TRANSLUCENCY.	
The tumor is frequently translucent at the upper portion of the sac.	The tumor is not translucent.
REDUCTION OF TUMOR.	
The reduction of the fluid contents and the intestinal portion of the tumor leaves the testicle apparent, which also reduces with a gurgle and marked pain.	The reduction of the tumor leaves the testicle *irreducible*.
AGE AFFECTED.	
Never affects adults unless a previous attack has existed in infancy.	Is most common in infancy, but *may* occur at any age from an abnormal condition of the parts.

DISEASES OF TISSUES.

DISEASES OF TISSUES.

BEFORE proceeding to the considerations of the surgical diseases of tissues, it may not be out of place to hastily review the essential points pertaining to inflammatory processes in general, and, subsequently, to note the characteristic peculiarities which are assumed, when certain individual structures are affected. The subject is one of too great magnitude to consider in detail, and the following tables and classifications can hardly serve as more than a guide to the reader, in case the subject prove one of special interest to him.

While inflammation and its results are present in almost every form of disease to which the attention of the surgeon is directed, and, for that reason, should be thoroughly mastered, still the compass of this work precludes the lengthy discussion of pathological processes, and can admit of little more than is absolutely required to afford the student or practitioner a *practical insight* into its bearings upon diagnosis.

INFLAMMATION.

DERIVATION. *Flamma, φλέγμα—to set on fire.*

DEFINITION. An abnormal condition of tissue, dependent upon irritation, associated with vascular and cellular changes, and alteration in the nutrition and function of the affected part.

INFLAMMATION may be classified
- (1.) on a pathological basis.
- (2.) on a basis of its severity and duration.
- (3.) on a basis of its causation.

In accordance with the basis from which inflammation is considered, the following names have been applied to special conditions, which would perhaps be unintelligible to the reader, unless their meaning is first made clear by a short and concise definition.

A. Varieties (classified on a *pathological basis*).

(1.) VASCULAR. Where the *vessels* of the affected part exhibit the most marked inflammatory changes.

(2.) CELLULAR. Where the *cells* of the part are extensively involved.

(3.) NECROTIC. Where the inflamed part suffers death, from arrested nutrition.

(4.) NECROTIC-REPARATIVE. Where the affected part is *partly destroyed*, but eventually regains its activity (as in bruise).

(5.) HYPERPLASTIC. Where *new connective tissue development* is the chief feature.

(6.) TUBERCULAR. Where *miliary tubercle* is deposited.

B. Varieties (classified on a *basis* of its *severity* and *duration*).

(1.) ACUTE INFLAMMATION.
Where the changes in the affected part are rapid and the effects severe.

(2.) CHRONIC INFLAMMATION.
Where the changes in the affected part are gradually developed, and not of as severe a type as in the acute form.

C. Varieties (classified on a *basis of causation*).

(1.) TRAUMATIC. When produced by external injuries, and mechanical or chemical violence.

(2.) INFECTIVE. When produced by the *transmission* of *infective materials*, by means of the blood-vessels or lymphatics, from some *local infecting centre* (as in acute pyæmia, miliary tuberculosis, etc.).

(3.) IDIOPATHIC. In which no obvious exciting cause exists.

(4.) SPECIFIC. Where the inflammatory process exhibits *distinctive peculiarities*, as in small-pox, syphilis, typhoid fever, diphtheria, scrofula, carbuncle, erysipelas, etc., etc.

In ACUTE INFLAMMATION,

The *irritation* must be severe to produce it.
The *duration* is usually short.
The *changes in tissues* are rapid.
The *injury sustained* by the *blood-vessels* and *tissues* is correspondingly severe.
The *vascular phenomena* are prominent.
The *exudative process* is excessive.
Suppuration is frequent.
Organization of the inflammatory products is rare.

In CHRONIC INFLAMMATION,

The *irritation* is usually slight.
The *duration* is usually prolonged.
The *changes in tissues* are slower and less extensive.
The *injury* to the affected tissues is less severe.
The *vascular phenomena* are less prominent.
The *exudative processes* are less abundant.
Suppuration is rare.
Organization of the inflammatory products is the rule.

ETIOLOGY. The causes of inflammation may be either *predisposing* or *exciting*.

PREDISPOSING CAUSES.

- CHRONIC INANITION (produced by poverty, bad atmosphere, etc.).
- OLD AGE (chiefly on account of defective heart power, and altered capillaries).
- EXHAUSTIVE DISEASES (*bed-sores* are an example of its results).
- LOCAL ARTERIAL DISEASE, LOCAL OBSTRUCTION OF VEINS (by causing imperfect nutrition to the tissues).
- PREVIOUS INFLAMMATION (by weakening the reactive power of tissues).
- ABUSE OF ALCOHOL.
- CLIMATE.
- TEMPERATURE (extreme heat or cold).
- ATMOSPHERIC POISONS (poisons of malaria, sewer gases, chemical vapors, etc.).
- BAD HYGIENIC CONDITIONS.

EXCITING CAUSES.

- **(1.) Direct Irritation** from chemical agents, viz.:
  - Heat.
  - Cold.
  - Acids.
  - Caustics.
- **(2.) Mechanical Injury.**
  - Introduction of foreign bodies (splinters, bullets, etc.).
  - Stabs.
  - Gun-shot wounds.
  - Lacerations.
  - Contusions.
  - Fractures.
  - Dislocations.
- **(3.) Influence of Morbid Products** generated within the body.
  - Calculi in the
    - Liver.
    - Kidney.
    - Salivary glands.
    - Prostate gland.
    - Lachrymal glands.
    - Joints.
    - Serous cavities.
  - Retained putrefactive excretions.
    - In the bladder.
    - In the rectum.
    - In the intestine.
    - Blood clots.
    - Tubercle.
    - Gangrene.
    - Sequestra.
- **(4.) Altered State of Local Nerves.**
  - Injury to the brain substance.
  - " " cranial nerves.
  - " " spinal cord and nerves.
  - " " sympathetic.
- **(5.) Abnormal Properties in Blood.**
  - *Deficiencies* in
    - Nitrogenized food.
    - Salts (chiefly those of *potash*).
    - Arterial supply.
  - *Abnormal ingredients.*
    - Poisons.
    - Purgatives.
    - Diuretics.
    - Emmenagogues.
    - Cathartics.
    - Uric acid.
    - Urea.
    - Lactic acid.
- **(6.) Direct Contagion** arising from
  - Gonorrhœal poison.
  - Chancroidal "
  - Syphilitic "
  - Vaccine virus.
  - Decomposing pus.
  - Contagious ophthalmia.

Results of Inflammatory Processes.

These may be divided into two great classes, viz:

- *Local changes* within the inflamed part.
- *Constitutional changes.*

Local Changes within the inflamed part.

A. *Rational Symptoms.*

- Impaired function.
- Pain.
- Heat.
- Redness.
- Swelling.

B. *Microscopical Changes.*

Changes in *Vessels.*

- Momentary contraction.
- Dilatation with fluxion (the blood current being more rapid than normal).
- Dilatation with congestion (the blood current being slower than normal).
- Transudation of plasma.
- Transudation of leucocytes and red corpuscles.
- Stasis.

Changes in *Tissues.*

Exudation.

- Sero-albuminous.
- Sero-fibrinous.
- Hemorrhagic.
- Pus.
- Catarrhal.
- Diphtheritic.

Due to altered nutrition.

- Cell-growth.
- Organization.
- Degeneration.
- Death.

Constitutional Changes.

- *Changes in Temperature* (modified by the severity of the inflammation and also by its type).
- *Changes in Pulse.*
- *Changes in Blood.*
  - Increase of fibrin.
  - " of albumen.
  - " of white globules.
  - Slow coagulation (causing the *buffy coat*).
  - Decrease in chlorides.
  - Increased *cohesiveness* of the red blood globules.

Theories Advanced as to the Causes of the Local Inflammatory Changes.

The results of inflammatory processes, as indicated in the table on the preceding page, have been, to the different observers, a subject for inquiry and investigation. It may not be out of place, therefore, to enumerate some of the *more important theories* which have, at different times, been advanced to explain them, since, by so doing, the student may be better able to appreciate them, and to realize the importance of their bearing upon the long list of diseases which are of inflammatory origin.

Each of the more important headings in the preceding table will, therefore, be separately considered where any theories have been advanced to explain them; the different theories being simply enumerated without elaboration or discussion. Other points of interest, which are not purely theoretical, will also be here and there inserted, when they seem to have a special bearing upon the subject.

A. MICROSCOPICAL CHANGES.

(1.) Cause of *momentary contraction* of the capillary vessels.
1st Theory. "Capillaries contract when irritated."
(This stage of inflammation is denied by some authors.)

(2.) Cause of *dilatation of the capillaries.*
1st Theory. "Direct paralysis of vessel."
2d Theory. "Extension of contraction (the first condition of the capillary vessel) to larger trunks, thus dilating the capillaries."
3d Theory. "Cell influence demanding increased nutrition."
4th Theory. "Reflex act through the sympathetic system."

(3.) Cause of *retardation of the blood current* (Ryneck's experiments).
1st Theory. This phenomenon is probably due to *changes in the capillary wall,* as shown by the two following experiments:
No stasis occurs in vessels whose vitality has been destroyed by poisonous metallic substances.
Stasis is produced by injections of milk or defibrinated blood.
2d Theory. It is possibly due to obstruction produced by the white globules adhering to the walls of the capillary vessel.

(4.) Cause of *transudation of plasma elements.*

The walls of the blood-vessel become *thin and altered in their character* by being dilated, and thus allow of easy transudation.

(5.) The *transudation of white corpuscles.*

Discoverers, Addison—1842. Cohnheim, of Berlin—1867.

The white globules are observed at first to become stationary, and subsequently to protrude themselves through the wall of the blood-vessel, without leaving an apparent orifice. It is possibly due to the power of amœboid movement possessed by the white blood-corpuscle.

(6.) Cause of *nutritive cell activity.*

1st Theory. (Stricker.) "*Stimulation of the cells by liquor sanguinis.*"

Stricker excised a piece of the cornea and inserted it under the membrane covering the opposite cornea, and thus produced inflammation of *both.*

2d Theory. "*Nervous irritation*" of the cells.

3d Theory. *Transmission of irritation from the adjacent elements* to the cell elements.

(7.) *The transudation of red blood-corpuscles.*

Occurs in mechanical hyperæmia, but in less quantities than the white. Is often associated with either a rupture of the vessel or some alteration in its coats.

B. RATIONAL SYMPTOMS (*localized in the inflamed part*).

(1.) Cause of PAIN.

Pressure upon, or stretching of the nerve filaments by the hyperæmia and exudation.

(2.) Causes of HEAT.

(1.) *Hyperæmia* of the affected part.

(2.) *Increased chemical action.*

(3.) Causes of REDNESS.

(1.) *Hyperæmia* of the affected part.

(2.) *Hemorrhage* into the tissues.

(4.) Causes of SWELLING.

Effusions of serum or *white corpuscles* into the tissues.

Increased cell-growth.

Variations in the Rational Symptoms of Inflammation.

The REDNESS may vary both in *degree* and in *tint.*

The *intensity* of red indicates the *amount of blood* in the part.

The *tint* of red indicates the *rate of circulation.*

Redness need not necessarily indicate inflammation, since it may exist independently of inflammatory processes.

It is not well marked in *non-vascular tissues*, as in cartilage, the cornea, etc.

The SWELLING varies,

With the ability of the tissue to *hold exudation* or to *allow of cell-growth.* Is most marked, therefore, in loose areolar tissue or in tissues adjacent to it, in synovial sacs, and in the lungs and the kidneys.

The PAIN is modified in *degree*,

(1.) By the anatomical seat of the inflamed part.

(2.) By the density of the tissues surrounding the seat of inflammation.

(3.) By the character of the inflammation.

The pain during inflammatory process may also vary in its *character.* It may be of the following types:

Throbbing or pulsatile.
Burning (chiefly in *surface* inflammations).
Prickling.
Tingling.
Growing.
Starting (chiefly present in inflamed joints).
Sensitiveness to pressure.

Superficial desquamative inflammations are generally comparatively *painless*, as in catarrhal inflammations, nephritis, etc.

Organs of special senses, when inflamed, give *special symptoms* which are equivalent to pain.

Bitterness in throat exists in posterior faucial catarrh.
Unnatural sounds exist when the ear is affected.
Sparks or flashes of light exist when the eye is inflamed.

The pain of inflammation may not be felt *alone in the inflamed part.*

Ophthalmic tension is often felt in the *brow.*
Hip-joint disease is often felt in the *knee.*
Renal inflammation is often felt in the *bladder and penis.*
The pain produced by inflammation of the liver is often felt in the *right shoulder.*

Inflammation of the pelvic viscera is often felt in the *thigh.*

The LOCAL HEAT in inflammation is modified,

(1.) By the activity of the inflammatory process.

(2.) By the variety of inflammation present (least in the necrotic type).

(3.) By the constitutional condition of the patient.

The FUNCTION of the INFLAMED PART is usually impaired.

As examples of this fact, the bladder cannot retain urine, the eye cannot bear light, a joint cannot be moved, the ear loses its normal function or abnormal noises are present.

THE CONSTITUTIONAL EFFECTS OF INFLAMMATION.

(1.) ELEVATED TEMPERATURE.

If sudden in its rise, it is accompanied by *chill or rigors.*

It is greatly modified by the state of the blood, the state of the nervous system, the seat of inflammation.

It is usually associated with diminished or arrested secretion, as evidenced by the following conditions:

High-colored urine.
Confined bowels.
Coated tongue.
Marked thirst.

Theories of causation of inflammatory fever.

(1.) *Increased elimination* of *nitrogenous, sulphurized,* and *phosphorized* products.

(2.) *General systemic infection.*

(3.) *Nervous influence* on the *capillaries.*

(2.) PULSE OF INFLAMMATION.

The pulse is usually *accelerated and full* in inflammation, and is, as a rule, *hard, tense, and wiry* if serous membranes be inflamed.

(3.) BLOOD CONDITIONS in inflammation.

The *fibrin* is *increased* from 2 parts as high as 10 parts in 1000. (Andral's researches.)

The existence of fibrin as a distinct element is now questioned by some authorities.

Slow coagulation, producing the "buff" and "cup" condition in from 8 to 40 minutes, is present in inflammatory blood.

A buffed condition may, however, also occur in pregnancy, plethora, or after severe exercise. If due to inflammation, it is greatest when fibrous or serous structures are inflamed, and least when the mucous or tegumentary structures are involved.

The clot of inflammatory blood is shaped like a truncated cone, and is less firm in texture at its base than in healthy blood.

White globules are increased in their proportion to the red blood-globules during inflammation; *the albumen* is usually *increased;* a *marked decrease* in the *chloride salts* of the blood and secretions may exist; the *water* of the blood is *diminished;* and the *blood-globules* exhibit an *unnatural cohesiveness.*

Exudation, in inflammation, may be of six varieties, as follows:

(1.) *Sero-fibrinous* (water, fibrin, and salts).
(2.) *Sero-albuminous* (water, albumen, and salts).
(3.) *Hemorrhagic.*
(4.) *Pus.*
(5.) *Catarrhal* (consists of pus-corpuscles, mucus, desquamated epithelium, and a sero-albuminous fluid).
(6.) *Diphtheritic.*

Both varieties of serous exudations contain an excess of the *chlorides, phosphates,* and *carbonates* over other salts. Exudation differs with the variety of tissue affected. It is least abundant in dense organs and non-vascular tissues, and most abundant in organs with a lax structure and in inflammations of a free surface (mucous or serous).

SPECIAL TYPES OF INFLAMMATION.

A. Inflammation of *mucous membranes* may be of two types,

(1.) Catarrhal,
(2.) Croupous or Fibrinous.

(1.) CATARRHAL INFLAMMATIONS.

In the *milder* forms of catarrhal inflammation, the changes which result are as follows:

(1.) Hyperæmia.
(2.) Increased secretion of mucus.
(3.) Proliferation of epithelium.
(4.) Slight transudation of leucocytes.

In the *severer* forms of catarrhal inflammation, there exists, in addition to the above,

(1.) Desquamation of the epithelium, leaving abrasions on the surface.

(2.) Infiltration of the submucous tissues with the products of cell-growth.

(3.) Follicular ulceration, from hyperplasia of the lymphatic structures.

(4.) The *glands* become obstructed with epithelium, and ulcerate or atrophy.

In the *chronic* types of catarrhal inflammation, the following changes may be noticed:

(1.) The vascularity is not as great as in the acute type.

(2) Proliferation of cells takes place, both in the epithelial and subepithelial structures (causing thickening).

(3.) The lymphatics become permanently enlarged.

(4.) Abrasion or ulceration may ensue.

(2.) FIBRINOUS OR CROUPOUS INFLAMMATION.

This is a more *severe type* than the catarrhal variety, and is characterized by an excess of fibrin exuded. This fibrin may be *within* or *upon* the mucous membrane, and, if upon the free surface, may result in the formation of complete casts of the inflamed surfaces.

Fibrinous inflammations may exist in

Croup.
Diphtheria.
Dysentery.
Severe irritation of mucous membranes.

It is usually a *catarrhal* process in its commencement.

It may result in "*false membranes*" when the fibrin is very large in amount.

In diphtheria, the exudation is largely *within* the submucous tissue.

B. INFLAMMATION OF SEROUS MEMBRANES.

Steps: (1.) Hyperæmia.

(2.) Endogenous growth in epithelial cells.

(3.) Loss of lustre in membrane.

(4.) Opacity and roughening in membrane.
(5.) Fibrinous exudation. If serum be present it is always *turbid*, thus indicating its inflammatory character.
Pus occurs in the *specific types* of disease.
(6.) Absorption of the fluid exudation.
(7.) *Adhesive inflammation* (hyperplastic). Due either to fibrillation of the fibrin and elongation and union of cells, or to irregular papillary outgrowths from the inflamed surfaces.

C. INFLAMMATION OF LYMPHATIC STRUCTURES.

This form of the inflammatory process includes the following conditions:

(1.) Acute inflammation of lymphatic glands and vessels.
(2.) Chronic inflammation of lymphatic glands and vessels.
(3.) Typhoid intestinal lesions.

Acute inflammation of lymphatic structures may result from
Wounds.
Extension of inflammation.
Sympathy. (As occurs during attacks of gonorrhœa.)
Poisons. { Putrefactive matters. / Snake bites.

Chronic inflammation of lymphatic structures may result from
Scrofula.
Prolonged irritation.

The symptoms by which the *acute form* of inflammation of the lymphatics is manifested may be enumerated as follows:

(1.) Redness of the skin along the course of the lymphatic vessels.
(2.) Swelling of the inflamed part and tenderness to pressure.
(3.) Violent pain.
(4.) Enlarged glands.
(5.) Frequent suppuration of the glands or in the connective tissue surrounding them.

In the *chronic* type of disease, where the lymphatics are affected, the glands undergo either

(1.) Fatty degeneration.

(2.) Caseous degeneration.
(3.) Calcareous degeneration.

In typhoid fever the solitary glands and Peyer's patches, and often the mesenteric glands, undergo special changes peculiar to the blood condition of that disease, which, however, do not pertain to a surgical treatise, and must, therefore, be found by reference to works on pathology.

I shall consider diseases of tissues in the following order:

A. INFLAMMATORY CONDITIONS OF TISSUE.

Under which head may be enumerated

1. TUMEFACTION. Tumefaction of tissue always accompanies severe forms of inflammatory processes. It is due to the excessive supply of blood furnished by the dilated capillary vessels, and frequently to an accompanying œdema of the inflamed tissues. It is associated, as a rule, with local pain and tenderness to the touch, and is characterized also by a local and, possibly, a general rise in temperature.

2. INDURATION. Induration of tissue depends upon an abnormal connective-tissue cell-growth and its organization and development into new tissue.

   It is the associate of chronic or sub-acute inflammatory processes, as a rule, since, in the *acute* form, the new cell-growth is often too rapid to undergo organization, and suppuration follows.

   Inflammatory indurations of tissue are usually unassociated with pain or local symptoms after the cause has disappeared, and are slowly removed by nature, in the majority of instances, through a process of fatty degeneration and absorption. A diagnosis is therefore made from its mode of origin and gradual disappearance.

3. SUPPURATION OF TISSUE. Suppuration of tissues may accompany superficial ulcerative or granulative processes, or may be, in itself, a circumscribed process of destruction of tissue. In the former conditions, pus is an unimportant element, but, in the latter, it occasions marked and peculiar symptoms, and has received a special nomenclature.

Circumscribed pus may exist as *acute* or *chronic abscess*, *furuncle*, *anthrax*, *suppurative inflammation of glands* and *organs*, and as a symptom of *pyæmia*.

It frequently results in the formation of *sinuses* and *fistulæ*, when the source of irritation remains, as in caries, necrosis, foreign bodies, etc., etc.

The *character* of pus is liable to variations, and separate names have been given the most common varieties. Thus *healthy* or *laudable*, *ichorous*, *sanious*, *curdy*, *muco-pus*, and *sero-pus* are terms most frequently used to express the existing condition and appearance of the discharge.

Suppuration, if circumscribed and retained within tissue, yields both local and constitutional symptoms.

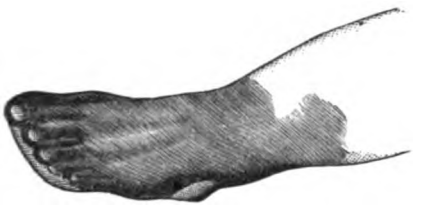
The local symptoms are the development of a tumor, which is at first hard, but afterwards soft or fluctuant, and a change in the skin, which often becomes red, shiny and œdematous if the suppuration be near the surface.

The constitutional symptoms are chills, fever, and elevation of the pulse, followed by *hectic* and exhaustion, if the suppuration be extensive.

4. Ulceration of Tissue. By an *ulcer* is meant a superficial solution of continuity of soft tissues, dependent upon *molecular* death. The process of ulceration can never occur *within* the substance of any tissue; it is essentially a condition of the surface. Ulceration may affect the *cutaneous* and *mucous surfaces* of the body, the *lining coat of the blood-vessels* and *serous membranes*.

Ulceration may be the result of, 1. *Enfeebled circulation* or *defective nutrition* from lack of blood, as exists in newly formed cicatrices, the lower limbs in the aged, the alæ of the nose, and the cornea of the poorly nourished. 2. In *specific diseases*, as in scurvy, scrofula, some forms of syphilis, lupus, etc., etc. 3. In *direct inflammation* of an intense character, as in severe mechanical injury, the application of a chemical irritant or long-continued pressure upon a circumscribed locality producing injury to the surface. 4. *Abnormal blood conditions*, independent of congenital or acquired diathesis, may tend

PLATE XX.



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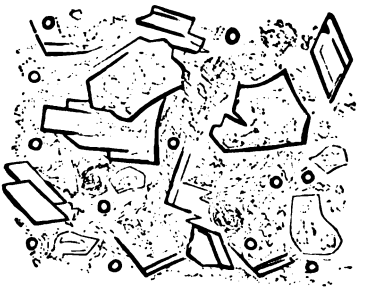

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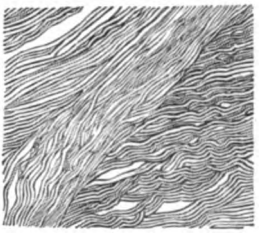

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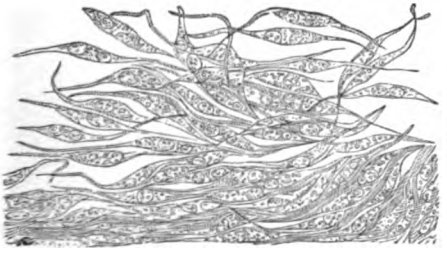

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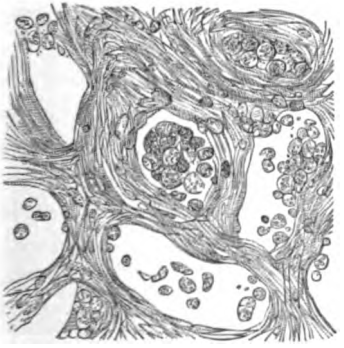

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1. Gangrene. 2. Contents of a sebaceous cyst. 3. Lipoma. 4. Fibroma. 5. Spindle-celled sarcoma. 6. Enchondroma. 7. Scirrhous cancer. 8. Epithelioma.

to excite ulceration of the serous lining of the blood-vessels and other serous structures.

Ulcers may be classified as *healthy, weak, indolent, irritable, hemorrhagic, inflamed, varicose,* and *phagœdenic.* The appearance of the edges of the ulcer and of the granulations upon its surface will characterize the first six of these, while the history of origin, and rapidity of development by sloughing, will render the other two obvious.

B. GANGRENE OF TISSUE. A condition dependent upon an absolute and permanent *arrest of nutrition* to some local part of the body, provided that part retains to a greater or less degree its external form and anatomical characters, is termed "gangrene."

The appearance of the affected part depends upon its previous vascularity, its solidity of structure, the cause and rapidity of the gangrenous process, and the presence or absence of exposure to the air.

Gangrene may be divided into moist, dry, and hospital gangrene, on the basis of its appearance and origin. Of these, the first depends upon *obstructed venous return;* the second upon *impaired arterial supply;* the third upon some *epidemic poison* causing a tendency to phagœdena.

Gangrene may result from local violence, excessive heat or cold, escharotics, inflammatory congestion and œdema, embolism, thrombosis, ligature of vessels, pressure of tumors, abnormal blood conditions, as in uræmia, fevers, etc., etc., old age, atheroma, and in severe malarial affections in children. Gangrene also follows excessive doses of ergot and phosphorus, and the inoculation of farcy, or glanders poison.

Its symptoms depend upon its variety. In the dry form of gangrene, a simple withering and mummifying process occurs. In the moist variety, the part becomes dark, soft and infiltrated with gases from decomposition, causing an emphysematous crackling if pressure be made upon the part affected. It is characterized by blebs upon its surface, is offensive in odor, and finally separation of the *sphacelus* or *slough* occurs.

In hospital gangrene, a phagœdenic process commences within a wound and symptoms of pyæmia often rapidly follow. It is markedly contagious and usually fatal.

C. ERYSIPELAS. Erysipelas is a diffuse inflammation of the skin, mucous, or serous membranes, which rapidly spreads over large surfaces, and is accompanied with febrile movement.

It is, clinically, of three varieties: 1. *Cutaneous* erysipelas, where only the superficial portions of the skin are involved. 2. *Phlegmonous* erysipelas, where the subcutaneous cellular tissue is affected as well as the derma. 3. *Internal* erysipelas, where serous or mucous membranes are involved.

The face is the most frequent seat of the cutaneous form. It commences usually with a chill, rise in temperature to 103°–104°, nausea or vomiting, and frequent stupor or delirium.

The face becomes reddened and œdematous, the features distorted by swelling, and the eyes closed from œdema when the lids are implicated.

The constitutional symptoms increase with the advance of the disease and terminate with its abatement, in from eight to twelve days. As the skin grows pale, it becomes scaly, abscesses or boils frequently occur, and the beard falls out but subsequently returns.

Erysipelas occurs most in the spring and fall of the year. It may follow absorption of poisonous matter by the lymphatics, and frequently accompanies suppuration, when occurring within the body. It occurs in the debilitated, and in those addicted to alcohol, especially when subjected to injury. It is claimed that diabetes and Bright's disease predispose to it, and it has by no means been proven to be non-contagious. It is a frequent complication of wounds, especially those of the head and hands.

The phlegmonous form occurs most often in the legs. It is associated with great tension of the affected part, subsequent sloughing of the skin, and exhaustive suppuration. Its duration depends on its severity.

D. ELEPHANTIASIS ARABUM.—"*Barbadoes Leg;*" "*Pachydermia.*" Elephantiasis consists of a hypertrophy of all the structures of which the integumentary covering of the body is composed. The epidermis becomes thickened, roughened as in *ichthyosis*, and intersected with

fissures. The chorium is increased in thickness, and the subcutaneous connective tissue is infiltrated with a gelatinous material, which oozes out on section of the skin, and quickly coagulates. This disease is due largely to an engorgement of the *lymphatic* vessels. It begins as an erysipelas with an œdematous swelling of the lymphatic glands, or as an eczema, phlebitis, or lymphangitis.

Elephantiasis may affect the feet, legs, scrotum, penis, labia and clitoris. The size of the affected part often becomes immense. This disease is essentially one of hot climates. It is endemic in the East Indies, Syria, Japan, Egypt, the Barbadoes, and occasionally on the continents of Europe and America. It seldom begins before puberty, and is most frequent in males. It is sometimes hereditary. The absence of luxuriant vegetation seems to favor its development.

When the scrotum becomes affected, as it frequently does, either independently, or when a similar condition of the leg exists, the penis is usually drawn into the tumor, as it enlarges, and becomes lost to view.

The disease exerts little, if any, influence upon the general health. Patients live for years, burdened with the weight of the growing tumor, without impairment of any vital function. In advanced stages of the disease, obstinate ulcers often form upon the affected parts, or abscesses and even gangrene occur. An acute attack of erysipelas occasionally acts as a cause of death in these cases.

E. LUPUS.—"*Lupoid Ulceration;*" "*Lupus Vulgaris.*" This disease attacks the face, nose, cheeks, ears, buttocks and extremities. The trunk is rarely affected.

It is also frequently found in the mucous membrane of the lips, hard palate, and throat. It begins as a brownish-red spot, which varies in size from that of a pin's head, to a pea, and which subsequently becomes papular, or elevated, with a frequent increase in its size. This papule next undergoes cell infiltration and becomes nodular in appearance, and in a more advanced stage leads to the formation of an ulcer, through fatty degeneration or molecular destruction of tissue.

The ravages of this ulcerative stage are often terribly severe and associated with marked deformity.

This disease occurs often in children, even as early as three years of age, but it requires at this early age several years to develop. It makes the most rapid strides during puberty.

As it occurs most often upon the face, especially about the nose and mouth; and ectropion, or eversion of the eyelid, not infrequently occurs from contraction of the tissues of the cheek.

Epithelial cancer is sometimes developed from lupus after that disease has lasted for years.

The cause of lupus is unknown. It does not develop as rapidly as syphilides, and is often present where the parents are not diseased. It fails also to respond to specific treatment. It is sometimes associated with scrofulous glandular enlargements.

In the preceding pages I have hastily enumerated those changes in tissues, exclusive of tumors, which are most liable to be of surgical interest and value. I have avoided lengthy explanations of pathological processes, but have been forced to enter somewhat into their etiology, as it has a direct bearing upon the subject, which seems, to my mind, sufficient to demand it. I have arranged in the form of diagnostic tables the various forms of abscess, which are frequently encountered, and the diseases with which they are most liable to be confounded. I have also added as a guide to memory differential tables between dry gangrene and moist gangrene, and cutaneous and phlegmonous erysipelas.

ANTHRAX (Carbuncle).	FURUNCLE (Boil).
Age Affected.	
Occurs during or after *middle* life.	Occurs at any age.
Location.	
Occurs in cellular tissue which is largely supplied with vessels. It is chiefly developed on the *posterior surface* of the trunk, and is seldom present upon the extremities.	May occur in any locality.
Shape of Tumor.	
The tumor is elevated, but has a *flat* surface.	The tumor is usually *conical* in shape.
Pointing.	
The tumor never points.	The tumor points rapidly.
Method of Evacuation.	
The tumor opens at several places and becomes honey-combed in appearance.	The tumor bursts at one spot only, as a rule.
Contents Evacuated.	
The discharge of pus occurs, and long glistening shreds of dead connective tissue subsequently protrude.	The contents of the tumor are chiefly pus.
Base of Tumor.	
The base is deeply indurated.	The base is little indurated and the outline of the tumor is indistinctly circumscribed.
Constitutional Effects.	
The effects upon the constitution are severe and often alarming.	The constitutional effects are slight in degree, or absent.
Results.	
Is not infrequently fatal.	Is seldom, if ever, fatal.

ABSCESS.	LOCAL ŒDEMA, *if circumscribed.*
PAIN.	
The pain is markedly increased by pressure.	Pain on pressure is slight or absent.
PALPATION.	
The tumor is hard at its circumference, but is soft or elastic in its centre.	The tumor is of uniform consistence throughout.
FLUCTUATION.	
The tumor fluctuates as suppuration advances.	The tumor never fluctuates.
CHILLS.	
Rigors are often present if the suppuration be extensive.	Chills are absent, unless some complication exists.

SYMPTOMS IN COMMON.

Both may be associated with pain.
" " " " redness of the skin.
" " " " marked local swelling.
" " " " elevation of local temperature.
" " " " constitutional disturbance.

ACUTE ABSCESS.	CHRONIC OR COLD ABSCESS.
AGE AFFECTED.	
May occur at any age.	Is most common in the young.
HEALTH.	
Often affects the healthy.	Occurs in the debilitated, especially in those of scrofulous or lymphatic temperaments.
POINTING.	
The tumor points rapidly.	The tumor points very slowly.
TEMPERATURE.	
The temperature of the body is often markedly elevated.	The general temperature is nearly normal.
PULSE.	
The pulse is usually increased.	The pulse is usually normal.
SKIN.	
The integument over the tumor is usually red, œdematous and adherent to the surrounding parts.	The skin is usually pale and seldom œdematous or adherent.
SIZE OF TUMOR.	
The tumor is seldom very large.	The tumor is often immense in size.

SYMPTOMS IN COMMON.

Both are associated with an abnormal tumor.
" " " " fluctuation.
" " " " a detection of pus by the aspirator or exploring needle.
" " " " pointing.

ILIAC ABSCESS.	ABSCESS OF ABDOMINAL WALL.
ORIGIN.	
Follows parturition, instrumental delivery, or puerperal fever.	Is usually independent of parturition.
PAIN.	
The pain is often very severe and is accompanied, frequently, with rigors.	Pain is often not markedly severe nor are constitutional symptoms so frequently present.
SITUATION OF TUMOR.	
The tumor lies *deep* in the iliac fossa.	The tumor is *superficially* located.
INTEGUMENT.	
The skin is involved *late*, if ever.	The skin is involved early in the disease.
MOBILITY OF TUMOR.	
The tumor is *immovable* and hard at its commencement.	The tumor allows of slight movement with the abdominal walls.
RECTAL AND VAGINAL EXAMINATION.	
The tumor is definitely located by a rectal and vaginal examination, or by conjoined manipulation.	The tumor cannot be detected through the vagina or rectum.
BLADDER AND RECTUM.	
The bladder, and often the rectum is affected by pressure of the tumor.	The bladder and rectum are not affected.
DIRECTION OF ESCAPE OF PUS.	
The pus may be evacuated through the vagina, uterus, bowel, bladder, skin of the thigh, through the sciatic notch appearing upon the buttock, or into the peritoneal cavity.	The pus is usually evacuated directly through the integument over the seat of the tumor.

PSOAS ABSCESS.	FEMORAL HERNIA.
SITUATION OF THE TUMOR.	
The tumor, if in the thigh, lies *outside* of the femoral vessels.	The tumor lies *inside* of the femoral vessels.
PERCUSSION.	
The percussion note over the tumor is dull.	Resonant percussion over the tumor *may* exist.
PAIN.	
A pain in the back or loins has always preceded the development of the tumor.	The tumor may be unassociated with pain.
FLUCTUATION.	
The tumor is fluctuant, if superficial.	The tumor never fluctuates.
HISTORY.	
The tumor is preceded by a history of spinal disease, or of a pelvic affection.	The tumor follows some severe muscular strain, as a rule.
BOWEL.	
No intestinal embarrassment is present.	The intestinal function is often interfered with.
GENERAL HEALTH.	
The general health is impaired.	The general health may be normal.
REDUCIBILITY.	
The tumor reduces under direct pressure, but no gurgle on reduction is perceived.	The tumor is reduced by pressure *downwards*, *backwards* and *upwards*, and a gurgle is detected as the tumor disappears.
TENDENCY TO RETURN.	
The tumor returns when pressure is removed.	The tumor will not return, as a rule, as long as a recumbent position is maintained.

ABSCESS OF ABDOMINAL WALLS.	ENLARGED SPLEEN.
SITUATION.	
The tumor is superficial.	The tumor is deeply situated.
MOBILITY.	
The tumor is only slightly movable.	The tumor is freely movable.
PRESSURE.	
The tumor is sensitive to pressure.	The tumor is not sensitive to pressure.
FLUCTUATION.	
Fluctuation appears as the disease advances.	Fluctuation is always absent.
PAIN.	
The pain is local and constant.	No pain exists, as a rule.
TEMPERATURE AND PULSE.	
The temperature and the pulse are usually increased.	The temperature and pulse may be affected if malarial enlargement exists.
RIGORS.	
Chills may be present.	Chills are absent, save in malaria.
HISTORY.	
A history of contusion, or of some exciting cause exists.	The tumor develops without any apparent causation.
INTEGUMENT.	
The skin is usually involved and becomes red and œdematous, as pointing takes place.	The integument is normal in its appearance.

MOIST GANGRENE.	DRY GANGRENE.
ETIOLOGY.	
A condition of obstructed *venous* return is present, as a rule, although abnormal blood conditions as produced by fevers, uræmia, farcy, etc., etc., may excite this form of gangrene.	A condition of impaired *arterial* supply exists, which is dependent upon atheroma, embolism, pressure upon the vessels, ligature, old age, ergot poisoning, etc.
APPEARANCE OF AFFECTED PART.	
The diseased part is dark in color, soft, often *emphysematous* from gases due to decomposition, dotted with blebs upon its surface and of offensive odor.	The affected part undergoes a process of desiccation, becoming, in time, shrivelled and mummified without odor or decomposition.
CONSTITUTIONAL EFFECT.	
Septicæmia is often produced by absorption of the decomposing animal material by the lymphatic vessels.	Blood poisoning, as evidenced by pyæmic or septicæmic symptoms, is infrequent.
PROGRESS.	
The disease progresses rapidly, as a rule.	The disease is frequently of long duration.

SYMPTOMS IN COMMON.

Both are associated with *diminished temperature* in the affected part.
" " " " diminished sensibility " " "
" " " " altered color " " "
" " " " spontaneous separation of the " "

CUTANEOUS ERYSIPELAS.	PHLEGMONOUS ERYSIPELAS.
ORIGIN.	
Is usually of idiopathic origin.	Is generally the result of injury penetrating to the cellular tissue.
SKIN.	
The skin is uniform in its redness when the erythema is fully developed.	The color of the skin is not uniform at the onset, but is usually darker at the centre.
SWELLING.	
Swelling may often be absent or slight in amount, but when extensive pitting on pressure exists.	A swelling is marked from the onset which at first pits on pressure, but the skin soon becomes too tense to admit of pitting.
PAIN.	
A tingling and itching pain is at first experienced, which subsequently becomes of a smarting character.	A burning and often a severe pulsating pain is present at the onset which lasts till the *tension* is relieved.
SUPPURATION.	
Suppuration is seldom produced, the attack subsiding with desquamation of the cuticle.	Suppuration forms on the seventh or eighth day, and is preceded by softening of the affected part, return of pitting on pressure and a sense of fluctuation.
SLOUGHING.	
Sloughing is rarely, if ever, produced.	Sloughing of the skin rapidly follows unless the tension is relieved and the pus evacuated. The wound being afterwards characterized by the protrusion of dead connective tissue in the form of white glistening shreds.
TERMINATION.	
Is usually associated with a good prognosis unless the meninges become affected.	Frequently kills by exhaustion, if extensive, or by blood poisoning.

TUMORS.

TUMORS may be of two great classes, *fluid* and *solid:* the former are called cysts or cystic tumors; the latter are usually named and classified on a basis of their anatomical construction, as revealed by microscopical examination. Solid tumors comprise both inflammatory and non-inflammatory growths, although that term is more properly applied to new formations independent of a purely inflammatory origin.

The qualities which chiefly tend to characterize true tumors from other growths, are

1. A decided tendency to *continuously increase.*
2. An *inherent nutritive activity,* independent of the surrounding tissues.

In attempting to classify tumors, I am led to follow the arrangement of T. Henry Green, of London, as it seems to me more clearly to elucidate this obscure subject than any other classification with which I am acquainted, and combines both simplicity of language with clearness of expression.

Solid tumors may be divided then into three great types: 1. Those of the type of *connective tissue,* in which the stroma of the tumor is usually in excess of the cell element, and the cells are those of the type of normal connective tissue. 2. Those of the type of *higher tissues,* as muscle, nerves, and blood-vessels; and 3. Those of the type of *epithelial structures,* as represented by glandular tumors, cancer, and papillomata. The following table will clearly explain this classification:

- **SOLID TUMORS.**
  - **Tumors of the *connective tissue* type:**
    - Fully developed connective tissue. — "*Fibroma.*"
    - Embryonic connective tissue (Sarcoma). — *Fibro-Plastic.*; " *Recurrent.*; " *Nucleated.*; *Myeloid.*; *Glioma.*
    - Granulation tissue. — *Psammoma.*; *Gummata.*; *Lupus.*; *Glanders.*
    - Mucous tissue. — *Myxoma.*
    - Adipose tissue. — *Lipoma.*
    - Cartilage tissue. — *Enchondroma.*
    - Lymphatic tissue. — *Lymphoma.*; *Leukæmia.*; *Tubercle.*
    - Bone tissue. — *Osteoma.*
  - **Tumors of the *higher tissue* type:**
    - Type of muscle. — *Myoma.*
    - " " nerve. — *Neuroma.*
    - " " blood-vessels. — *Angioma.*
  - **Tumors of the *epithelial* type:**
    - Papillomata; growing from — *Cutaneous surface.*; *Mucous* "; *Serous* "
    - Adenoma. — *Glandular tumors.*
    - Carcinoma. — *Scirrhus.*; *Encephaloid.*; *Epithelioma.*; *Colloid.*

Cystic tumors may also be divided into two great classes with their subdivisions, as shown in the following table, in which not only the varieties of cysts are enumerated, but the mechanism of their formation is also clearly explained.

CYSTIC TUMORS.

- **A. Cysts formed in *pre-existing* cavities.**
  - **Retention Cysts; (due to *obstructed escape* of secretion).**
    - Sebaceous cysts.
      - True sebaceous tumors.
      - Comedones.
      - Atheromatous tumors.
    - Mucous cysts.
      - Occur only in mucous follicles.
    - Cysts in organs or glands.
      - Ranula, due to occlusion of sublingual ducts.
      - Encysted hydrocele, due to occlusion of tubuli testis.
      - Mammary cysts, due to occlusion of lacteal ducts.
      - Simple cysts of the ovary, due to dilatation of Graafian follicle.
      - Compound cysts of the ovary, due to dilatation of Graafian follicle.
      - Cysts of the liver, due to occlusion of ducts.
      - Cysts of the kidney, due to occlusion of tubes.
  - **Exudative Cysts; (due to excessive secretion).**
    - Bursæ.
    - Ganglia.
    - Hydrocele.
    - Cysts of broad ligament.
  - **Extravasation Cysts; (due to hemorrhage into closed cavities).**
    - Hæmatocele.
    - Sanguineous tumors.
- **B. Cysts formed in sacs of *independent* origin.**
  - Cysts due to *softening* of tissues in the centre of tumors, as in
    - Lipoma.
    - Enchondroma.
    - Sarcoma.
  - Cysts due to *expansion* and *fusion* of the spaces in connective tissue.
    - New bursæ.
    - Serous cysts of the neck.
    - Compound ovarian cysts.
  - Cysts formed around *foreign bodies.*
    - Parasites.
    - Extravasated blood.
    - Bullets, etc., etc.
  - *Congenital* Cysts.
    - Frequently resulting from a blighted ovum. They often contain hair, bones, teeth, etc., etc.

Tumors may be again classified on the basis of *location* as follows:

- **A. TUMORS OF THE HEAD.**
  - *Brain.*
    - Cysts.
    - Glioma.
    - Myxoma.
    - Lipoma.
    - Carcinoma.
    - Psammoma.
    - Gummata.
    - Cholesteatoma.
    - Tubercle.
    - Hydatids.
  - *Scalp.*
    - Lipoma.
    - Sebaceous.
    - Vascular.
  - *Orbit.*
    - Glioma.
    - Myxoma.
    - Cystic.
    - Osteoma.
    - Medullary Cancer.
  - *Antrum.*
    - Cystic.
    - Erectile.
    - Osseous.
    - Fibroid.
    - Enchondroma.
    - Lipoma.
    - Encephaloid.
  - *Gums.*
    - Cystic.
    - Fibrous.
    - Carcinoma.
    - Myeloid.
  - *Lips.*
    - Cystic.
    - Epithelioma.
    - Lupus.
  - *Tongue.*
    - Cystic.
    - Fibroid.
    - Gummata.
    - Epithelioma.
    - Encephaloid.
  - *Jaws.*
    - Cystic.
    - Fibroid.
    - Myeloid.
    - Osteoma.

B. TUMORS OF THE NECK.

- *Vessels.*
  - Encysted Aneurism.
  - Diffuse "
- *Muscles.*
  - Cystic.
  - Lipoma.
  - Myoma.
- *Parotid Gland.*
  - Cystic.
  - Fibrous.
  - Enchondroma.
  - Hypertrophy.
  - Abscess.
  - Cancer.
- *Thyroid Gland.*
  - Cystic.
  - Hypertrophy.
  - Encephaloid.
- *Lymphatic Glands.*
  - Lipoma.
  - Hypertrophy.
  - Abscess.
  - Syphilitic Induration.
  - Tuberculous "
  - Cancer.
- *Integument.*
  - Fibroid.
  - Serous Cysts.
  - Moles.
  - Warts.
  - Keloid.
  - Eloid : (coil-like tumor).
- *Mucous Membranes of Pharynx, Œsophagus, and Larynx.*
  - Cystic.
  - Myxoma.
  - Fibroma.
  - Adenoma.
  - Sarcoma.
  - Papillomata.
  - Carcinoma.

C. TUMORS OF THE TRUNK.

- *Mammæ.*
  - Cysts.
  - Fibroma.
  - Adenoma.
  - Enchondroma.
  - Lipoma.
  - Scirrhus.
  - Encephaloid.
- *Labia.*
  - Cysts.
  - Abscess.
  - Hæmatocele.
  - Epithelioma.
- *Uterus.*
  - Cystic.
  - Fibroid.
  - Myoma.
  - Enchondroma.
  - Pulsatile.
  - Carcinoma.
- *Rectum.*
  - Fibrous.
  - Fatty.
  - Carcinoma.
- *Prostate.*
  - Hypertrophy.
  - Abscess.
  - Scirrhus.
  - Encephaloid.
- *Testicle.*
  - Cysts.
  - Tubercular deposits.
  - Gumma.
  - Enchondroma.
  - Benign fungus.
  - Carcinoma.

Special *surgical regions* may also present an abnormal appearance, either from a local increase in size, or from the presence of some abnormal and well-defined tumor, which may demand extreme care in diagnosis, and which, for that reason, I have concluded also to tabulate. Of these special surgical regions, the *axilla* and the *groin* are the two most frequently affected with abnormal tumors, whose diagnosis is rendered difficult from their situation and depth.

Tumors of the *axilla* may be thus enumerated:

- **AXILLARY TUMORS.**
  - Dependent on blood-vessels.
    - Aneurism.
    - Hæmatocele.
  - Of lymphatic type.
    - Cancer of lymphatic glands.
    - Tubercular infiltration of glands.
    - Inflammatory enlargement of glands.
    - Enlargement of glands from hyperplasia.
  - Dependent on bone.
    - Dislocation of the head of humerus.
    - Displaced head of humerus in fracture.
    - Fragments of bone.
    - Separation of the great tubercle.
    - Osseous tumors.
  - Axillary abscess.
    - Due to suppuration of glands.
    - " " " connective tissue.
    - " diseases of ribs.
    - " " " cervical vertebra.
    - " " " shoulder joint.
    - " " " scapula.
    - " empyema.
  - Dependent on organs.
    - Hernia of the lung.

- TUMORS OF THE GROIN.
  - Abscess of local origin.
    - Due to perityphlitis.
    - " empyema, the pus burrowing through diaphragm.
    - " disease of hip joint.
    - " pelvic suppuration.
    - " suppuration about kidneys.
    - " caries of vertebral column. (psoas abscess).
  - In region of inguinal canal.
    - Lymphatic glands.
    - Lipoma of canal.
    - Hydrocele of spermatic cord.
    - Hæmatocele " "
    - Hernial protrusion.
    - Arrested testicle.
    - Cysts.
  - In the region of femoral canal.
    - Enlarged lymphatic glands.
    - Varix of the saphenous vein.
    - Dislocated head of femur.
    - Enlarged bursa underneath the psoas tendon.
    - Psoas abscess.
    - Femoral aneurism.
  - In the iliac fossæ.
    - Ovarian tumors.
    - Fibrous "
    - Impacted fæces.
    - Aneurism of iliac arteries.
    - Abscess of abdominal walls.

CANCER.

In the preceding pages, I have classified tumors in general, and I now proceed to the consideration of those special forms of tumor, termed by some authors *malignant*, and included under the general head of *carcinoma*.

Cancer is properly an anatomical term used to include all forms

of new growth consisting of cells of an epithelial type, embedded in the alveoli of a fibrous stroma, and destitute of intercellular substance. It has been defined by Waldeyer as an *atypical epithelial neoplasm.* It includes four distinct varieties: 1. *Scirrhus.* 2. *Encephaloid.* 3. *Colloid,* and 4. *Epithelioma.* The colloid variety, termed also *gelatiniform* and *alveolar* cancer, is, in reality, but a *degenerative stage* of one of the other three varieties, and by some authors is considered under the head of "colloid degeneration," since this change may likewise occur in tumors not possessing the microscopical characteristics of carcinoma.

Cancerous tumors are always malignant, but all malignant tumors are not cancerous, since they fail to present the microscopical appearance of cancer. They are however, *clinically,* of equal importance, and I have, therefore, arranged in contrast the points in diagnosis between malignant and benign tumors, for the purpose of aiding in their clinical discrimination.

SYMPTOMS OF CANCER.

Scirrhus.

The scirrhus variety, called also the *chronic* or *fibrous form* of cancer, is usually a primary type of disease. It is characterized chiefly by its slow development, its stony hardness, and by a tendency to pucker and depress the adjacent tissues before the disease reaches the stage of ulceration.

It is most frequently present in the breast of females, and is occasionally present in the alimentary canal and its accessory organs. If present in the breast, it seldom reproduces its own type elsewhere.

In this form of cancer, the ulcerative process is slow, and is developed late in the disease. It is seldom associated with severe hemorrhage.

As seen by the microscope, scirrhus is characterized by an excess of the fibrous stroma over the cellular elements, which accounts for its solidity; and its tendency to pucker and depress adjacent tissues is explained as a result of the contraction of its newly formed connective tissue.

Encephaloid.

This form of cancer, called also *acute* or *medullary,* is usually a secondary disease, some other form having first developed.

It is extremely malignant in its progress, grows rapidly, invades

all surrounding tissues, ulcerates early in its course, is associated often with early and profuse hemorrhages, and is rapidly fatal.

To the touch, this form is *soft, lobulated,* and often *elastic.* It is most commonly present in the various organs, and in glandular structures.

On inspection it *resembles brain tissue,* from which resemblance it gains its name; and it is characterized under the microscope by the remarkable *excess* of the *cellular elements* over the stroma.

Epithelioma.

To this form, the terms "*epithelial* cancer," "*clay-pipe* cancer," and "*chimney-sweep* cancer" are often applied, since it occurs from irritation, such as soot or the heat of a pipe, and affects epithelial structures. It is usually, in all its forms, a primary disease of a *cutaneous* or *mucous surface,* and is rarely found in the viscera.

It begins, as a rule, either as a nodule or as a small indolent ulcer, which steadily advances, in spite of ordinary forms of treatment. It is most common upon the lips, tongue, anus or scrotum, and penis.

If the ulcerating surface, or an incision into the tumor be compressed, a *thick, crumbling, curdy mass* is often exuded in a *worm-like form,* which, if placed in water, does not tend to diffuse itself, and which the microscope shows to consist of epithelial cells closely packed together.

Under the microscope, a section of the tumor reveals epithelial cells arranged as *eggs in a nest,* or in the form of *concentric spheres.*

It is clinically of comparatively long duration, unless some other form of cancer be simultaneously present in other regions of the body.

Colloid.

This form of cancer, called also the *alveolar* or *gelatinous,* variety, is most frequently met with in the stomach, peritoneum, and the intestine.

It has a tendency to spread rapidly to adjacent tissues, and is a frequent associate of other forms of cancer.

It is questionable if it properly deserves to be classed as a separate type of disease, as it is more properly a degenerative process of other forms of cancer or sarcoma.

To the eye, colloid deposits have a glistening, jelly-like, and translucent appearance.

The microscope shows the existence of *large spherical cells*, which often present distinct *laminæ*, and which contain within their interior drops of colloid material.

I shall defer the full description of the symptoms of each of the four varieties of cancer, as they are to be found enumerated in the diagnostic tables pertaining to each. I have inserted in this chapter among *special* forms of cancer, only malignant disease of the axilla and omentum, as similar disease in other localities will be found described in other chapters of this work.

BENIGN TUMORS.	MALIGNANT TUMORS.
Relation to Surrounding Parts.	
Are not intimately attached to the surrounding tissues.	Are infiltrated into the tissues and often embody the surrounding structures in their own substance.
Multiplicity.	
Are frequently solitary. If multiple they start simultaneously and advance with the same degree of rapidity. They also affect, when multiple, the *same type* of tissue.	Tend to reproduce themselves, and multiple tumors appear in succession. They often involve many distinct localities and also affect *different types* of tissue.
Rapidity of Growth.	
The tumors grow *slowly*, as a rule, and, when developed, are often stationary for years.	The tumors grow with great rapidity, when once fully developed.
Ulceration.	
No tendency to ulcerate is marked, but ulceration *may* exist.	A marked and uncontrollable tendency to ulceration exists.
Tissues about Ulcer.	
The tissues near the ulcer are either healthy or simply indurated from inflammation.	The tissues near the edges of the ulcer are altered in their structure from the normal type.
Duration of Ulcer.	
The ulcer heals easily when irritation is removed, or, if extensive ulceration exists, the disease is in time destroyed.	No tendency towards spontaneous repair is manifested, but the disease develops in direct proportion to the rapidity and the extent of the ulcerative process.
Structure of Growth.	
The tumors are homologous and homomorphous. They are similar to some natural tissue of the body.	Are heterologous and heteromorphous. They differ in their structure and arrangement from natural tissues.
Constitutional Effects.	
No constitutional effects are developed.	Constitutional effects are present and well marked in the later stages of the disease.

SCIRRHUS (Fibrous or Chronic Cancer).	ENCEPHALOID CANCER (Acute or Medullary Cancer).
Origin.	
Is usually a primary disease.	Occurs, most often, as a secondary affection.
Rapidity of Growth.	
The tumor develops slowly.	The tumor develops rapidly.
Palpation.	
The tumor is *hard* and *stony*.	The tumor is soft, lobulated and often elastic.
Integument.	
The skin is usually puckered and depressed before ulceration commences.	The skin is neither depressed nor puckered.
Ulceration.	
The tumor ulcerates late and slowly, as a rule.	The tumor ulcerates early in the disease and progresses rapidly.
Hemorrhage.	
Hemorrhage from the tumor occurs late in the disease.	Hemorrhage occurs early in the disease.
Seat.	
Is usually present in the breast; it seldom reproduces itself in organs as scirrhus. It may be frequently found also in the alimentary canal.	The tumor is very malignant and tends to rapidly invade organs and glandular structures.
Stroma.	
The stroma, as seen by the microscope, is large in quantity.	The stroma is small in quantity. The tumor resembles brain tissue, on section.

EPITHELIOMA (Epithelial Cancer; Clay-pipe Cancer; Chimney-sweep's Cancer).	SCIRRHUS (Fibrous or Chronic Cancer).
Location.	
Is usually a primary disease of mucous or cutaneous surfaces. It is rarely found in internal organs.	Occurs in the mammary gland and alimentary canal, in the majority of cases. The stomach, œsophagus and rectum are its most frequent locations internally.
Mode of Origin.	
Begins as a small ulcer, or as a nodule which subsequently ulcerates.	It seldom, if ever, commences as an ulcer.
Cut Surface of Tumor.	
If pressure be made upon the scraped or cut surface of the tumor, a thick, crumbling, curdy material is exuded, often in a *worm-like* form. This exudation consists of epithelial scales.	A *juice* is extracted from the cut surface, or by scraping the central or softer portions. This juice consists of cells, nuclei and granules.
Effect of Dilution.	
This expressed material does not become *diffused* in water, but remains as minute visible particles.	The juice of scirrhus, when mixed with water, becomes *diffused* and often lost.
Microscope.	
A small section of the tumor, under a microscope, reveals *epithelial nests* and *epithelial spheres*.	A section of the tumor reveals excessive development of a fibrous stroma and epithelial cells in a state, often, of atrophy.

COLLOID CANCER (ALVEOLAR OR GELATINOUS CANCER).	SCIRRHUS OF ORGANS.
LOCATION.	
Is most frequent in the stomach, intestines and peritoneum.	Is a rare disease of organs, save in the œsophagus, at the pylorus, and in the rectum.
DEVELOPMENT.	
The tumor develops rapidly.	The tumor is slow in development.
MALIGNANCY.	
It frequently spreads to glands and adjacent tissues.	It is the least malignant of carcinomatous tumors.
APPEARANCE OF CUT SURFACE.	
Has a glistening, jelly-like, translucent appearance. Its constituents resemble mucin, save that they contain sulphur and do not precipitate on the addition of acetic acid.	It is a hard, nodular mass, whose cut surface is dense and compact.
MICROSCOPE.	
A markedly developed alveolar structure exists, with large *spherical* cells, which are often *laminated* and which contain colloid material in the form of drops.	A fibrous stroma is detected, which is excessively developed, and the cell element is often detected in a stage of atrophy after the tumor has reached advanced stages.
ORIGIN.	
Is not a distinct variety of cancer, but is a *degenerative process* of other growths, as scirrhus, encephaloid, sarcoma, etc., etc.	It is a distinct type of cancer, and is often dependent on hereditary predisposition.

CANCER OF AXILLARY GLANDS.	TUBERCULAR DISEASE OF AXILLARY GLANDS.
AGE AFFECTED.	
Is seldom present in children.	Is most frequent in children.
HISTORY.	
No scrofulous history is present.	A scrofulous history exists.
GROWTH.	
The tumor grows rapidly, in many cases.	The tumor is of slow growth.
MOBILITY.	
The tumor is often restricted in its mobility.	The tumor is very movable.
NUMBER.	
The tumor may be solitary.	The tumors are usually multiple.
NEIGHBORING PARTS.	
The neighboring parts are often affected, especially the mammæ.	The surrounding parts are not affected.
TERMINATION.	
Ulceration rapidly develops after the tumor has become superficial.	Suppuration occurs in the majority of cases, and its evacuation is preceded by a sense of fluctuation within the tumor.
EFFECTS OF REMOVAL.	
A return of the disease, after removal of the tumor, within two years is frequently present.	The disease shows no tendency towards a return after removal.

CANCER OF OMENTUM.	ENLARGED SPLEEN.
PERCUSSION.	
The area of dulness extends *across* the abdomen, but is not conveyed backwards.	The area of dulness seldom crosses to the right of the median line, and is always conveyed *backwards*.
LOCATION OF TUMOR.	
It never ascends behind the ribs.	It frequently ascends behind the ribs.
SURFACE OF TUMOR.	
Palpation detects a rough and uneven surface.	The surface of the tumor is smooth and regular.
DENSITY OF TUMOR.	
The tumor is *hard* as a rule.	The tumor is soft to the touch.
ASCITES.	
Ascites is a frequent complication.	Ascites is seldom present.
HISTORY.	
A cancerous hereditary taint is often found.	A malarial history is most frequent.
CACHEXIA.	
A cancerous cachexia is developed as the disease advances.	A cachexia is not developed.
PAIN.	
Pain is a prominent symptom in the advanced stages.	Pain is usually absent.
AGE AFFECTED.	
Occurs chiefly after forty.	May occur at any age.
EFFECTS OF PRESSURE.	
Tenderness on pressure is common.	The tumor is not usually sensitive to pressure.

TUMORS OF THE HEAD.

The various tumors of the *cranium* which are met with in a surgical practice are

1. Sebaceous Tumors of the Scalp.
2. Fatty " " "
3. Exostoses of the Skull.
4. Abscess.
5. Cephalæmatoma.
6. Encephalocele.
7. Dropsy of the Meninges of the Brain.
8. Hernia Cerebri.

The tumors of the *face* include

1. Cysts of the Antrum.
2. Solid Tumors of the Antrum.
3. Abscess " "
4. Tumors of the Orbit and Eyelids.
5. Cancerous Tumors.
6. Lupus.
7. Fatty Tumors.

The tumors of the *mouth* include

1. Ranula, a cystic tumor from obstruction of sublingual ducts.
2. Epulis, a fibrous tumor of the periosteum of the gum.
3. Parulis, a local suppuration of the gum.
4. Enlargement of the Tonsils.
5. Tumors of the Tongue, encysted, fatty, gumma, erectile, and cancer.
6. Polypi.
7. Hypertrophy of the Palate.

In the following pages will be found diagnostic tables between such of these conditions as are most liable to be confounded. Some of these, however, have been previously recorded under *special types* of bone diseases, but are intentionally duplicated as they properly belong to each division.

SEBACEOUS TUMORS OF THE SCALP.	FATTY TUMORS OF THE SCALP.
COMPARATIVE FREQUENCY.	
These tumors are most frequent in this locality.	Fatty tumors are most frequent upon the back and shoulders, but may exist in any locality, and not infrequently upon the scalp.
MOBILITY.	
The tumor is freely movable under the skin.	The tumor frequently involves the skin.
PALPATION.	
The tumor is *tense, smooth* and *elastic.*	The tumor is soft and doughy.
OUTLINE OF TUMOR.	
The tumor is distinct and regular in its outline.	Outline irregular and indistinct.
ORIFICE OF DUCTS.	
A black speck on the tumor indicates the obstructed duct of the sac.	The sebaceous ducts are normal and unobstructed.
EFFECT OF PRESSURE.	
The tumor can often be *evacuated* by firm pressure.	The tumor cannot be evacuated by pressure.
SIZE OF TUMOR.	
The tumor is of moderate size.	The tumor may become very large.
SUPPURATION.	
The tumor frequently suppurates and occasionally ulcerates.	The tumor seldom suppurates or ulcerates spontaneously.
ODOR.	
The tumor is often associated with an offensive odor, from an escape of its contents.	The tumor is without odor.

SEBACEOUS TUMORS.	EXOSTOSES OF CRANIUM.
PALPATION.	
The tumor is *tense, smooth* and *elastic* to the touch.	The tumor is of bony hardness.
MOBILITY.	
The tumor is freely movable under the skin.	The tumor is immovable.
APPEARANCE ON INSPECTION.	
On careful inspection of the tumor, the obstructed duct will be perceived as a *black* speck upon its surface.	The tumor exhibits no unnatural condition of the integument or its glands.
EFFECT OF PRESSURE.	
On firm pressure the contents of the sac of the tumor may often be evacuated as a cheesy mass.	Pressure upon the tumor causes no evacuation of contents.
ODOR.	
An offensive odor is occasionally associated with the tumor from a slight escape of its contents.	The tumor is odorless.

SYMPTOMS IN COMMON.

Both are frequently multiple.
" " of slow growth.
" " distinctly circumscribed in their outline.

EXTRA-CRANIAL TUMORS.	INTRA-CRANIAL TUMORS.
RESPIRATORY MOVEMENTS.	
The tumor exhibits no movements during respiration.	The tumor rises with *expiration* from obstructed venous return to the chest, and falls during inspiration.
SIZE OF TUMOR.	
The size of the tumor never exhibits sudden and temporary variations.	The tumor frequently *enlarges* on severe attacks of coughing or crying.
EFFECT OF PRESSURE.	
The tumor cannot be made to disappear within the cranium by pressure. No cerebral symptoms are produced by pressure.	The tumor can often be reduced, either entirely or in part, by direct pressure upon it. Symptoms of *cerebral compression* are often produced in case the pressure be severe or long continued, but they usually cease when the pressure is removed, as the tumor returns to its former position.
CONDITION OF CRANIUM.	
The bony walls of the cranium are intact.	An *aperture* can often be detected in the cranial bones on reduction of the tumor.

SYMPTOMS IN COMMON.

Both may be associated with an absence of cerebral disturbance.
" " " " similarity in feel and consistence.
" " " " rapid or slow formation.
" " " " an absence of apparent causation or a knowledge on the part of patient or friends of a congenital defect or deformity.

ENCEPHALOCELE.	DROPSY OF THE BRAIN.
SITUATION.	
Occurs at the occiput, sutures, anterior fontanelle, and occasionally at the root of the nose between the two halves of the frontal bone.	Is most frequent at the anterior and posterior fontanelles, but may also be apparent at any of the cranial sutures.
CONTENTS OF TUMOR.	
The protrusion consists chiefly of brain substance.	The tumor is due to an excessive amount of fluid within the membranes of the cerebrum, and the protrusion of the membranes.
APPEARANCE OF TUMOR.	
The tumor is usually *pediculated.*	The tumor seldom, if ever, is pediculated.
TRANSLUCENCY.	
The tumor is *opaque.*	The tumor is usually translucent.
RAPIDITY OF GROWTH.	
The tumor seldom enlarges after birth, but if so, its development is very slow.	The tumor frequently enlarges rapidly and results in marked deformity.

SYMPTOMS IN COMMON.

Both are usually congenital tumors.
" " " painless.
" " " soft and possibly elastic.
" " " bluish in color.
" " " covered by thinned and altered integument.
" " " reducible within the cranium.
" " often associated with respiratory movements.
" " " " " pulsation.

ENCEPHALOCELE.	CEPHALÆMATOMA.
History of Tumor.	
Is usually congenital.	Occurs, after birth, in infants.
Situation.	
Is frequent at the fontanelles and cranial sutures.	Is never confined to sutures and seldom involves them. Is usually located upon some individual bone of the cranium.
Effect of Pressure.	
Pressure upon the tumor causes reduction within the cranium and possible cerebral symptoms.	Pressure upon the tumor causes no cerebral symptoms nor a reduction of the tumor.
Fluctuation.	
Fluctuation is absent.	Fluctuation is present in the tumor before coagulation occurs.
Pulsation.	
Pulsation is sometimes present within the tumor.	Pulsation within the tumor is rare.
Respiratory Movements.	
Respiratory movements within the tumor are generally present.	Respiratory movements are absent.
Size of Tumor.	
The tumor is generally of moderate dimensions.	The tumor may often be diffused over a large area.
Integument.	
The skin over the tumor is usually very thin and altered in its structure and appearance.	The integument over the tumor is usually normal.

ABSCESS OF ANTRUM.	SOLID TUMORS OF ANTRUM.
DEFORMITY.	
The antrum is equally distended.	The antrum is *unequally* distended.
INFLAMMATORY SYMPTOMS.	
Acute *inflammatory symptoms* are present, such as Chills, Great pain, " sensitiveness to touch, Œdema of face, Increased pulse, and " temperature.	No acute inflammatory symptoms are present, (such as pain, œdema, great sensitiveness, and constitutional disturbance).
FLUCTUATION.	
Fluctuation often appears in advanced stages.	Fluctuation is absent, as a rule.
DISCHARGE INTO MOUTH OR NOSE.	
A tendency to the discharge of pus through the teeth sockets, or through the nostril during forced expiration, or in certain positions of the body.	No tendency towards a spontaneous discharge of the contents of the cavity of the antrum is apparent.
EXPLORING NEEDLE.	
The exploring needle in cases of doubt decides the diagnosis.	The exploring needle gives negative results.

SYMPTOMS IN COMMON.

Both are often associated with projection of the eyeball.
" " " " effacement of the nostril.
" " " " depression of roof of mouth.
" " " " bulging of the cheek.
" " " " closure of the lachrymal duct.
" " " " interference with mastication.
" " " " " " deglutition.
" " " " parchment-like crepitus when the bone becomes thin.

EPITHELIOMA.	LUPUS.
Locations Affected.	
Affects principally the lips, cheeks, nose, forehead, and scrotum. It is also found frequently on the mucous membranes of the tongue, prepuce, labia, uterus, and bladder.	Affects the face, nose, ears, cheeks, buttocks, and extremities. It also affects the mucous membrane of the lips, hard palate, and throat.
Development.	
Begins either as a subcutaneous movable nodule, which undergoes ulceration, or as a small, foul ulcer with indurated edges.	Begins as a brownish-red spot, which subsequently becomes a papule and then ulcerates.
Age Affected.	
Occurs rarely, if ever, in the young, and is usually due to local irritation.	Occurs before middle life. It may often affect young children. Is not dependent upon local irritation.
Extent.	
Is gradual in its development, and is often unassociated with any very marked deformity.	Its ravages are often terribly severe, and the part affected undergoes, in some cases, marked and rapid deformity.
Surface of Ulcer.	
The surface of the ulcer is frequently papillated and villous, from an irregular growth of the corium. The surface is often friable, and on pressure frequently exudes a thick, crumbling and curdy material in a *worm-like* form. In some cases the ulcer is scabbed.	The ulcer may often be "serpiginous" in character. It may be scabbed, and, on removal of the scab, the surface may present irregular elevations and depressions on its surface. The skin, hair, sebaceous follicles and sweat glands, are often destroyed.
Repair.	
Seldom, if ever, tends towards spontaneous recovery.	The ulcer frequently heals with a depressed and puckered cicatrix.

TUMORS OF THE BREAST.

The mammary gland may be affected with the following conditions which result in its enlargement:

1. Acute Abscess.
2. Chronic Abscess.
3. Simple Cysts.
4. Compound Cysts.
5. Glandular Tumors.
6. Hypertrophy of the Mammæ.
7. Scirrhus.
8. Encephaloid Cancer.

Of these diseases, scirrhus and encephaloid have already been considered together under the head of cancerous tumors, and as they have no special distinctive features when confined to the mammary gland, that table will not be here duplicated. I have arranged the remainder in the form of diagnostic tables, with the exception of compound cysts, which cannot readily be distinguished from simple cysts of the breast, by the rational or physical signs pertaining to either. I have added also a diagnostic table between scirrhus, as the most frequent type of cancer in this locality, and innocent mammary tumors, since the importance of the discrimination can hardly be over-estimated.

ACUTE MAMMARY ABSCESS.	CHRONIC MAMMARY ABSCESS.
CONDITION OF BREAST.	
The breast is red, hot and œdematous.	Breast normal, or slightly œdematous at its lower margin.
ORIGIN.	
Follows traumatism or lactation.	Occurs after a period of uterine activity as in menstrual derangement, miscarriage, abortion, or normal confinement.
TUMOR.	
Is usually situated near the nipple and is fixed and often immovable.	The tumor is deep seated in the substance of the gland and is *movable*, as a rule.
The tumor develops rapidly and is very painful and sensitive to the touch.	The tumor develops slowly and is nearly painless, and not sensitive.
The nipple is usually affected.	The nipple is seldom involved.
INTEGUMENT.	
The skin becomes involved early.	The skin becomes involved late.
NUMBER OF TUMORS.	
The tumor is solitary.	The tumor may begin as a number of small nodules which subsequently coalesce.
FLUCTUATION.	
Fluctuation is distinct when the tumor is grasped and made prominent.	Fluctuation is often indistinct from the depth of the tumor and thickening of its wall, but *elasticity* is present.
CONSTITUTIONAL SYMPTOMS.	
The pulse and general temperature are markedly elevated.	The constitutional disturbance is slight and may be absent.
EXPLORING NEEDLE.	
Pus mixed with *milk* is often detected by the exploring needle.	Pus is withdrawn by the needle, but no evidences of *milk* are present.

CYSTS OF THE BREAST.	GLANDULAR TUMOR OF BREAST.
ORIGIN.	
May be due to obstruction of the milk ducts or to cysts of independent origin, (as per table on cystic tumors). Hydatid cysts are sometimes present.	Occurs most frequently in maidens between twenty and forty years of age, and is often associated with menstrual derangements or traumatism.
DEVELOPMENT.	
The tumor usually develops slowly, but may form rapidly after cessation of the menses or if due to hydatids.	The tumors are most frequently developed at the upper and inner portion of the breast, and, as a rule, grow slowly.
PALPATION.	
The tumor is smooth, circumscribed and movable. If due to hydatids, a peculiar fremitus on percussion is obtained.	The tumor is round, oval or lobular, *firm* and *incompressible*, and is very movable. In rare cases it may protrude through the skin, but does not ulcerate or bleed, as a rule.
FLUCTUATION.	
The tumor usually fluctuates.	The tumor never fluctuates.
TRANSLUCENCY.	
The tumor may be translucent if very superficial.	The tumor is opaque.
NEIGHBORING GLANDS.	
The neighboring glands are seldom involved.	The neighboring glands *may* be involved, but are usually not so.
EXPLORING NEEDLE.	
Milk, serum, or hydatid cysts may be obtained by an exploring needle from these tumors.	The results of the exploring needle are negative.

GLANDULAR TUMOR OF THE BREAST.	HYPERTROPHY OF MAMMÆ.
ORIGIN.	
Occurs most frequently in maidens between twenty and forty years of age, and is often associated with menstrual derangements or traumatism.	Is most frequent in the married during the term of pregnancy or menstrual derangement. It is never of traumatic origin.
LOCATION.	
The inner and upper portion of one breast is usually affected.	Both breasts are simultaneously enlarged, as a rule, and become very heavy.
MOBILITY.	
The tumor is usually very movable.	The breasts are usually less movable than normal.

SYMPTOMS IN COMMON.

Both are usually firm and incompressible.
" " " painless.
" " " of slow growth.
" " " unassociated with tegumentary changes.
" " " associated with normal health.
" " " free from enlargement of neighboring glands.
" " " characterized by a normal position and appearance of the nipple.

SCIRRHUS OF THE BREAST.	INNOCENT TUMORS OF THE BREAST.
OUTLINE OF TUMOR.	
The tumor is irregular in shape, nodular and indistinct at its circumference.	The tumor may be irregular, round or oval, and is usually distinctly circumscribed.
MOBILITY.	
The tumor is deeply attached to the gland, and, if movable, simply slides on the pectoral muscle.	The tumor moves freely within the breast itself.
PALPATION.	
The tumor is hard and *stony*.	The tumor is softer and more *elastic*.
WEIGHT OF TUMOR.	
The tumor is heavy.	The tumor is light.
BREAST.	
The breast is shrunken.	The breast is normal or increased in size.
PAIN.	
Lancinating, severe and paroxysmal pain exists in latter stages.	Pain is often absent. If present it is continuous and of moderate severity.
NIPPLE.	
The nipple is retracted.	The nipple is normal, as a rule.
AXILLARY GLANDS.	
The axillary glands are enlarged and hardened.	The axillary glands may be enlarged, but are never *hardened* or *fixed*.
GROWTH OF TUMOR.	
The tumor grows rapidly.	The tumor grows slowly and is often stationary for years.

SCIRRHUS OF THE BREAST (*continued*).	INNOCENT TUMORS OF THE BREAST (*continued*).
Ulceration.	
Ulceration is frequent, progressive and obstinate.	Ulceration is infrequent and easily treated.
Superficial Veins.	
The superficial veins are prominent and enlarged.	The veins are little affected.
Health.	
A cachexia is developed.	The general health remains good.
Complications.	
Cancerous tumors develop in other organs and tissues.	Complications are infrequent.

TUMORS OF THE UTERUS.

The uterus may become enlarged from the following named conditions:

1. Congestive Uterine Hyperæmia.
2. Fibroid Tumor.
3. Hydatids.
4. Retained Menstrual Blood.
5. Uterine Fibro-Cyst.
6. Uterine Polypus.
7. Uterine Moles.
8. Pregnancy.
9. Cancer of the Uterus.

I have treated of cancer in previous pages of this book, and shall not again consider it as a special uterine tumor, as it presents no special or distinctive characters in this region other than those perceived in all locations. It may primarily affect the body of the uterus or the cervix. I have added in the following pages, however, the symptoms of the various other conditions, resulting in uterine enlargement, in the form of diagnostic tables, as they are liable to be easily confounded with each other in diagnosis.

CONGESTIVE UTERINE HYPERÆMIA.	EARLY PREGNANCY.
DEVELOPMENT.	
The uterus ceases to develop in size after reaching moderate dimensions.	The uterus steadily increases in size till large dimensions are reached.
SENSITIVENESS.	
The tumor is tender and sensitive to pressure.	The uterus is not usually sensitive.
PAIN.	
A severe pain in the back and loins exists.	Pain in the back and loins is often absent, but, if present, is not severe.
WALKING.	
Walking becomes difficult from the existing pain.	Walking is not interfered with.
FŒTAL MANIFESTATIONS.	
After the fourth month all symptoms of pregnancy in its advanced stages are absent.	Evidences of fœtal presence exist after the fourth month, viz. : fœtal movements, quickening, fœtal heart, placental bruit, ballottement, etc.

SYMPTOMS IN COMMON.

Both are often associated with absence of the menses.
" " " " " vomiting.
" " " " " local uterine disturbance.
" " " " " vesical and rectal irritability.

FIBROID TUMOR OF UTERUS.	PREGNANCY.
MENSTRUATION.	
Menorrhagia or metrorrhagia is present, as a rule.	Amenorrhœa is usually present, but may be absent.
TUMOR.	
Nodules can be detected on palpation of the uterus.	The uterus is uniformly increased in size.
CONSISTENCE.	
The tumor is hard and resistant.	The tumor is more elastic.
CERVIX.	
The cervix is normal.	The cervix is often altered in its condition and appearance.
AUSCULTATION.	
The auscultatory signs are negative.	Fœtal heart and the placental bruit are heard after the fifth month.
FŒTAL MANIFESTATIONS.	
Quickening, fœtal movements and other manifestations are absent.	Fœtal manifestations develop, unless the fœtus be dead.
DURATION OF TUMOR.	
The duration of the tumor is indefinite.	The duration is limited.
LOCATION OF TUMOR.	
The tumor may not always be median in location.	The tumor usually lies in the median line.

RETAINED MENSTRUAL BLOOD.	PREGNANCY.
Condition of Sexual Organs.	
The sexual organs are abnormal. An examination may detect: Imperforate hymen; adhesion of vaginal walls; adhesion of lips of cervix; congenital defects; traumatic conditions.	The sexual organs exhibit no unnatural acquired condition, or abnormal development.
Menstrual Epochs.	
At each return of the normal date for menstruation the patient suffers intense pain, but does not menstruate.	The dates of ovarian irritation are not usually perceived during pregnancy, but, in rare cases, menstruation continues without any abnormal symptoms.
Constitutional Symptoms.	
The retention and decomposition of menstrual products create constitutional disturbances, which are often severely marked.	No constitutional disturbance, save from exhaustive vomiting, is perceived if the fœtus be alive, and no maternal disease exists.
Fœtal Manifestations.	
No evidences of fœtal life are detected.	Fœtal life is clearly indicated after the fifth month.

SYMPTOMS IN COMMON.

Both are usually associated with amenorrhœa.
" " " " " a uterine tumor.
" " " " " frequent local pains.
" " " " " vesical irritation.
" " " " " rectal "

UTERINE HYDATIDS.	PREGNANCY.
Development.	
The tumor develops with great rapidity.	The tumor develops with a moderate rapidity.
Uterine Discharge.	
Watery and bloody discharges from the uterus are frequently present.	Uterine discharge is usually absent, but a leucorrhœa may often exist.
Cysts are often spontaneously evacuated from the uterus.	Cysts are never evacuated.
Uterine Tenesmus.	
Uterine tenesmus is usually present.	Uterine tenesmus is usually absent.
Constitutional Disturbance.	
The evidences of constitutional disturbance are often well marked.	The constitutional disturbance is slight or absent, as a rule.
Auscultation.	
The auscultatory signs are negative.	Fœtal heart and placental bruit are heard after the fifth month.
Fœtal Manifestations.	
Fœtal manifestations are absent.	Fœtal movements and quickening are apparent, if the child be alive.

UTERINE FIBROID.	SOLID OVARIAN TUMOR.
MENSTRUATION.	
The tumor is usually accompanied by menorrhagia.	The menstrual function is often unaffected.
MOVEMENTS OF TUMOR.	
The uterus always participates in movements communicated to the tumor.	The uterus is usually independent of motions of the tumor.
MOVEMENTS OF UTERUS.	
The uterus, if moved by a uterine sound, affects the tumor.	The uterus, if moved, exerts no influence upon the tumor, as a rule.
MULTIPLICITY OF TUMORS.	
The tumors are often multiple.	The tumor is usually solitary.
PALPATION.	
The tumor is *hard*, incompressible and heavy.	The tumor is less dense, and lighter in weight.
UTERINE CAVITY.	
The cavity of the uterus is often increased, as revealed by measurement with the uterine sound.	The cavity of the uterus is normal in length.
CERVIX OF UTERUS.	
The cervix is in the median line, as a rule.	The cervix is often laterally displaced.
FLUCTUATION.	
Fluctuation is absent.	Fluctuation may be detected in localized spots on the tumor, if the tumor is compound in its character.

UTERINE FIBRO-CYST.	OVARIAN CYST.
DEVELOPMENT.	
The tumor grows slowly.	The tumor grows rapidly.
AGE AFFECTED.	
The tumor occurs after thirty years of age.	The tumor may affect any age after puberty.
CAVITY OF UTERUS.	
The uterine cavity is enlarged.	The uterine cavity is normal.
MOVEMENT OF TUMOR.	
The tumor, if moved, affects the uterus, and vice versa.	The tumor is independent of the uterus in many cases.
POSITION OF UTERUS.	
The uterus is often lifted out of the pelvis and can be detected above the pubes.	The uterus is usually displaced laterally within the pelvis.
The uterus is often in *front* of the tumor.	The uterus is generally *behind* the tumor.
HEALTH OF PATIENT.	
The health is little affected.	The health is undermined in two or three years.
FLUID OF TUMORS.	
The fluid, if withdrawn, coagulates quickly and spontaneously.	The fluid, if withdrawn, *never* coagulates.
MICROSCOPE.	
A peculiar "fibre cell," mentioned by Drysdale, is often detected.	Granular cells, epithelial cells and cholesterine are often detected.

UTERINE POLYPUS.	UTERINE FIBROID.
MOBILITY OF TUMOR.	
After the cervix has been dilated a *movable* tumor is perceived within the uterine cavity.	The tumor may often be felt externally, and in some cases only after dilatation of the cervix, but it is always immovable.
PALPATION.	
The uterus is smooth upon palpation of its external surface.	The uterus is nodular on its external surface, as a rule.
PEDICLE.	
The tumor is usually pediculated.	The tumor is seldom pediculated.

SYMPTOMS IN COMMON.

Both are often associated with menorrhagia.
" " " " " metrorrhagia.
" " " " " leucorrhœa.
" " " " " pain in the back and in the loins.
" " " " " dysmenorrhœa.

TUMORS OF THE OVARY.

The various tumors which affect the ovary and its appendages may be enumerated as follows:

1. Fibrous Tumors.
2. Fibro-cystic Tumors.
3. Carcinoma.
4. Cysto-carcinoma.
5. Dermoid Cysts.
6. Colloid Degeneration.
7. Hydatid Cysts.
8. Cysts of the Broad Ligament.

Ovarian tumors may be confounded in diagnosis with, 1. Ascites. 2. Pelvic abscess. 3. Cysts of the kidney. 4. Pregnant uterus. 5. Fibro-cyst of the uterus. 6. Uterine Fibroid. Two of these diagnoses have already been considered in contrast, under the head of tumors of the uterus; the others will be found arranged in the form of diagnostic tables in the ensuing pages.

OVARIAN DROPSY.	ASCITES.
Situation of Tumor.	
The tumor is most prominent upon one side, save in advanced stages.	The tumor is uniform and symmetrical.
Effect of Attitude.	
The tumor remains prominent and globular in all positions of the body.	The tumor *flattens* and *increases in its breadth* on lying down.
Fluctuation.	
The tumor is locally fluctuant.	The tumor fluctuates through the *entire abdomen.*
Origin.	
The tumor begins in one iliac fossa.	The tumor begins symmetrically from below.
Percussion Note.	
The percussion is dull in front when the patient lies upon her back, but is tympanitic, from displaced intestine, at the sides.	The percussion is resonant in front of abdomen, when patient lies on the back, as the bowel floats; but is *flat* at the sides of the abdomen.
Line of Dulness.	
Is constant and not affected by attitude.	Is variable, and is affected by attitude of patient and by amount of fluid present.
Palpation.	
Palpation detects an oval outline and an irregular surface to the tumor.	No circumscribed outline to tumor or irregularity of surface is discovered.
Cervix of Uterus.	
The cervix is normal in position.	The cervix is frequently displaced.
General Health.	
The health is usually good until the tumor becomes large.	The health is usually impaired from the commencement.

OVARIAN DROPSY (*continued*).	ASCITES (*continued*).
Œdema of Limbs.	
If present, œdema of the limbs *follows* the advent of tumor.	It often *precedes* the ascites.
Aortic Pulsation.	
Aortic pulsation *may* be transmitted.	Aortic pulsation is never present.
History.	
No apparent cause exists.	*Hepatic, cardiac,* or *renal* disease often co-exists.
Skin.	
Normal color and moisture of the skin exist.	The skin is often jaundiced, and is frequently dry like parchment.
Fluid Contents.	
The fluid, if drawn by aspirator, may reveal the following characteristics:	The fluid, if drawn by aspirator, may reveal the following characteristics:
1. Amber or brown in color.	1. Light straw-colored.
2. *Not spontaneously coagulable.*	2. Spontaneously coagulable, if fibrinous.
3. Specific gravity, 1018 to 1024.	3. Specific gravity, 1010 to 1015.
4. Paralbumen and metalbumen.	
Microscope reveals:	*Microscope reveals:*
1. *Granular* cells, which become *clear* by action of acetic acid, but not increased in size.	1. Pus cells.
2. Oil globules.	2. Oil globules.
3. Cholesterine and albuminoid matters.	3. Amœboid bodies.
4. Epithelium (cylindrical).	4. Squamous epithelium.

FLUID TUMORS OF THE OVARY.	PELVIC ABSCESS.
ORIGIN.	
The tumor is preceded by no inflammatory symptoms.	The tumor is preceded by symptoms of pelvic cellulitis.
EXTENT OF TUMOR.	
The tumor rises gradually above the umbilicus.	The tumor rarely extends to the umbilicus.
MOBILITY OF TUMOR.	
The tumor is movable, when of moderate size.	The tumor is fixed and immovable.
PAIN.	
The tumor is usually painless, and not sensitive to pressure.	The tumor is exceedingly painful, and is sensitive to the touch.
OUTLINE OF TUMOR.	
The tumor is distinct in outline.	The outline of the tumor is obscure.
DEVELOPMENT.	
The tumor develops slowly.	The tumor develops rapidly.
SUPPURATION.	
The tumor does not point or suppurate.	The tumor tends towards pointing and the evacuation of pus.
CONSTITUTIONAL SYMPTOMS.	
Inflammatory symptoms are absent during the development of the tumor.	Chills and often an elevation of pulse and temperature accompany the development of the tumor.
EXPLORING NEEDLE.	
The characteristic fluid of ovarian tumors, as described on preceding page, is withdrawn when the exploring needle or aspirator is used.	Pus is withdrawn after the tumor softens and becomes fluctuant.

UNILOCULAR OVARIAN CYST.	RENAL CYST, (DROPSY OR HYDATIDS).
INTESTINAL DISPLACEMENT.	
The tumor displaces the intestine backwards, as revealed by percussion.	The tumor displaces the intestine forwards.
URINARY CHANGES.	
The urine is normal.	The urine *may* contain pus, blood, or albumen. It may also occasionally be evacuated in sudden and large quantity, and the tumor then simultaneously subsides.
DEVELOPMENT.	
The tumor grows from below upwards.	The tumor grows from above downwards.
FREQUENCY.	
Is common, and affects all ages.	Is a rare disease.
MOBILITY.	
The tumor cannot be displaced upwards.	The tumor may possibly be capable of an upward displacement, so as to allow of *resonant* percussion above the pelvis.
ORIGIN.	
The tumor is never due to echinococci.	The tumor may be of hydatid origin, or may be due to obstructed escape of urine.
COLON.	
The tumor is never crossed by the colon, as shown by percussion.	The tumor is often *crossed* by the descending colon if on the left side.
The tumor lies internally to the ascending colon.	The tumor, if on right side, often lies *externally* to the ascending colon.
MENSTRUATION.	
Menstrual derangements are frequent.	Menstrual derangements are usually absent.
LOCATION OF TUMOR.	
The tumor involves both sides, if of large dimensions.	The tumor is unilateral.

OVARIAN TUMOR.	PREGNANCY.
Situation of Tumor.	
The tumor is not median in position till far advanced.	The tumor is median in its position.
Fluctuation.	
The tumor is often fluctuant.	The tumor is seldom, if ever, fluctuant.
Origin.	
The tumor begins in one iliac fossa.	The tumor begins in the median line.
Growth.	
The tumor grows slowly.	The growth of the tumor is rapid.
Uterus and Cervix.	
The uterus and cervix are normal.	The uterus and cervix are altered.
Menstruation.	
Menstruation is often unaffected.	Amenorrhœa is the rule.
Auscultation.	
No abnormal auscultatory sounds are detected.	Placental bruit and fœtal heart are heard after the fourth month, unless the child be dead.
Fœtal Manifestations.	
No quickening or fœtal movements are detected.	Fœtal manifestations are a prominent symptom.
Duration.	
Indefinite.	Limited.

SYMPTOMS IN COMMON.

Both may produce enlargement of the breasts.
" " " pain in the breasts.
" " " areola " "
" " " morning sickness.

TUMORS OF THE PELVIS.

The various types of tumor found within the pelvis may be enumerated as follows:

1. Pelvic Cellulitis.
2. Pelvic Peritonitis.
3. Pelvic Hæmatocele.
4. Extra-uterine Pregnancy.
5. Uterine Cancer.
6. Inversion of Uterus.
7. Uterine Fibroid.
8. Uterine Polypus.
9. Rectal Cancer.
10. Ovarian Tumor in Early Stage.
11. Osseous Tumors of the Pelvic Bones.
12. Vaginal Thrombus.
13. Vesical Calculus, (if large).
14. Hernia of Bladder or Rectum.
15. Prostatic Enlargement: (cancer, tubercle, abscess).

Many of these conditions have been treated of in preceding chapters of this work, and will be found included under the diseases of organs, or of special localities of the body. I shall present, therefore, in the following pages only diagnostic tables, in which are contrasted the symptoms of pelvic cellulitis, pelvic peritonitis, pelvic hæmatocele, extra-uterine pregnancy, vaginal polypus, and inversion of the uterus.

PELVIC CELLULITIS.	PELVIC PERITONITIS.
TUMOR.	
The tumor will be felt *low* down in the pelvis, and will be most marked on *one side*, as a rule.	The tumor, if detected, will be felt *high up* in the pelvis, and will be located in the *median line*, as a rule. A hardening of the whole pelvic roof is more common than a tumor.
MOBILITY OF UTERUS.	
The uterus will be *slightly* movable.	The uterus will be *immovable*.
SUPPURATION.	
Suppuration is usually produced.	Suppuration seldom occurs.
TYMPANITES.	
Tympanites is absent.	Tympanites is usually present.
APPEARANCE OF FACE.	
The expression of the face is normal.	The face has an anxious expression.
CONSTITUTIONAL EFFECTS.	
The constitutional effects are slight or absent.	Elevation of pulse and temperature, vomiting, tenderness of abdomen, etc., etc., are liable to exist.
RELAPSES.	
No tendency to relapses, during menstruation, is present.	Relapses are frequent at the monthly periods.
POSITION OF UTERUS.	
The uterus is not necessarily displaced.	The uterus is usually displaced by subsequent adhesions and contraction of new connective-tissue development.
HISTORY.	
Cellulitis most frequently follows parturition, abortion, or operations upon the pelvic viscera.	Peritonitis most frequently follows exposure during menstruation, disease of the ovaries, *gonorrhœa* and escape of fluids into the peritoneal cavity.

PELVIC HÆMATOCELE.	EXTRA-UTERINE PREGNANCY.
DEVELOPMENT.	
A tumor develops suddenly, with constitutional symptoms of hemorrhage, if due to traumatism; but slowly, if due to spontaneous effusion of blood.	A tumor develops slowly.
MENSTRUATION.	
Menstruation may be normal.	Amenorrhœa is usually present.
HEMORRHAGE.	
Symptoms of hemorrhage, if present, *precede* or *accompany* the development of the tumor.	Hemorrhage is liable to occur only *after* the tumor has developed.
UTERINE SYMPTOMS.	
The early symptoms of pregnancy are usually absent.	The early symptoms of pregnancy, viz.: morning sickness, suppression of menses, areola in breasts, kiestein in the urine, etc., etc., are often present.
FLUCTUATION.	
The tumor fluctuates at its commencement, but grows hard as coagulation of the blood advances.	The tumor is often fluctuant throughout its entire development.
TERMINATION.	
The tumor tends to decrease in size and disappear after the hemorrhage is arrested.	The tumor tends to develop or to rupture. In the latter case, death from hemorrhage or peritonitis is common.

VAGINAL POLYPUS.	INVERSION OF THE UTERUS.
Uterine Probe.	
The uterine probe, if passed through the vagina by the side of the tumor, will enter the body of the uterus.	The uterine probe will be arrested at the vaginal attachment to the uterus.
Rectal Examination.	
The uterine body can be detected in its normal position by the finger, when introduced into the rectum.	The finger in the rectum detects the absence of the uterus from its normal position.
Conjoined Manipulation.	
By pressing the abdominal walls firmly downwards towards the pelvis while the finger of the other hand is crowded by the side of the tumor into the vagina, the uterus can often be detected by one of the two hands.	The uterus is not detected, save as the cause of the vaginal tumor, by the same means of examination.
Recto-vesical Exploration.	
A sound introduced into the bladder will often reveal to a finger in the rectum an intervening tumor, which is the body of the uterus in its normal position.	No intervening tumor will be thus detected, save that in the vagina, and thus the diagnosis of inversion of the uterus may be verified.
Acupuncture.	
Acupuncture will give no pain.	Acupuncture will give pain.

TUMORS OF THE SPINE.

The tumors which are developed external to the spine comprise those of a congenital and an acquired variety and the condition called spina bifida. Among the different forms of congenital tumors of the spine which have been reported may be enumerated:

1. Parasitic growths (containing the remnants of an obliterated fœtus).
2. Cystic Tumors (simple and compound).
3. Fibroid Tumors.
4. Fatty Tumors.

Congenital tumors of the spine are most frequently located in the vicinity of the sacral or the lower lumbar regions. They are often connected directly with the spinal membranes, in which case the bony encasement of the spinal cord is locally deficient. They may be present upon the anterior or posterior aspect of the spine and are not infrequently intra-pelvic for that reason. If situated so as to press upon the pelvic viscera they may create a displacement of the coccyx, and a protrusion of the anus and perineum may be also produced.

If the tumor have a direct connection with the spinal membranes, it will, with few if any exceptions, lie in or spring from the median line.

If cystic in its variety it will usually reveal a contents similar to the cerebro-spinal fluid in its chemical composition provided any communication with the cavity of the arachnoid is present, and differs little, therefore, in its actual construction from that of spina-bifida.

Congenital tumors in the spinal region communicate in rare cases with the cavity of some viscus, as the intestine, rectum, bladder, etc. In this event a possible escape of the contents of the tumor into these various organs will be the only means of determining such an abnormal condition.

Spina Bifida.

This condition is in reality a congenital hernia of the spinal membranes through an abnormal opening in the vertebral column.

It is a frequent deformity and is either distinctly localized or affects the whole or greater portion of the spinal column. The sac

consists of the membranes of the spinal cord and in rare cases the substance of the cord itself is spread out as a thin layer on the internal surface of the membranous coverings.

Its contents consist of an excessive accumulation of the subarachnoidean fluid, occasionally portions of the cord itself or the cauda equina, and, in rarer instances, a deposit of fat and an increased quantity of connective tissue. The spinous processes of the vertebræ are absent over the tumor and the laminæ are either imperfectly formed or entirely absent. Spina bifida is not often present in the upper portions of the trunk, but is most frequently located in the lower dorsal or lumbar regions.

The symptoms of spina bifida and congenital fatty tumor arising from the membranes of the spinal cord will be given in the following pages. While they do not possess many points of strong resemblance, still the location of the tumors, their congenital origin, the deficiency of the spinous processes of the vertebræ, and the possibility of associate muscular changes, and nervous symptoms dependent on spinal lesions seem to warrant a contrast of symptoms rather than a separate enumeration of those associated with each.

Tumors of the Spinal Meninges.

These will be considered in a subsequent chapter, among the so-called "focal lesions" of the spinal cord. They produce symptoms which vary with the regions of the cord that are subjected to the pressure consequent upon their growth.

SPINA BIFIDA.	CONGENITAL FATTY TUMOR (CONNECTED WITH THE MEMBRANES OF THE SPINAL CORD).
APPEARANCE OF TUMOR.	
The tumor may be circumscribed or elongated for some distance in the longitudinal axis of the spine.	The tumor is usually distinctly circumscribed.
PALPATION OF TUMOR.	
The tumor is usually fluctuant or elastic.	The tumor never fluctuates. It is doughy and soft to the touch.
NUMBER OF TUMORS.	
Multiple tumors are not infrequent.	The tumor is usually solitary.
SIZE OF TUMOR.	
The tumor varies in size from that of a small bird's egg to the size of a child's head.	The tumor is seldom of large size.
EFFECT OF ATTITUDE.	
The tumor is usually tense when the patient stands erect. Is fluctuant usually when the patient lies upon the abdomen.	The tumor is not markedly affected by the attitude of the patient.
EFFECTS OF RESPIRATION.	
The tumor is often decreased in size by a full inspiration and is increased in size during expiration.	The tumor is not altered in size by the respiratory function.
EFFECTS OF PRESSURE.	
The tumor decreases in size on direct pressure being applied. If other tumors of the same variety co-exist, they often increase in size when the pressure is applied.	The tumor is often resistant to pressure and is, as a rule, but slightly affected.
Symptoms of spinal compression as evidenced by cries, pain, convulsions, paralysis, etc., etc., may accompany pressure if severely applied and disappear when the pressure is removed.	Symptoms of spinal compression as the result of direct pressure over the tumor are seldom present.

SPINA BIFIDA (*continued*).	CONGENITAL FATTY TUMOR (CONNECTED WITH THE MEMBRANES OF THE SPINAL CORD) (*continued*).
TRANSMITTED LIGHT.	
The tumor is often translucent, as is perceived by holding a candle behind it.	The tumor is always opaque.
APPEARANCE OF THE INTEGUMENT.	
The integument covering the tumor may be reddened, thinned and transparent, or even absent. In some cases however it is normal in appearance.	The integument is usually of normal color and appearance, but is, as a rule, adherent to the tumor.

SYMPTOMS IN COMMON.

Both may be associated with other congenital deformities such as hare-lip, cleft palate, imperforate anus, cranial protrusions, etc., etc.

" " " " imperfect development of the lower limbs.

Both are rare in the cervical region of the spine.

" reveal a long axis parallel with that of the spine.

" are usually broad at the base, but they *may* be pedunculated.

" may result in atrophy of the lower limbs.

" " " " paraplegia or extreme muscular weakness and retention or incontinence of urine if the tumor be situated above the second lumbar vertebra.

DISEASES

OF THE

BRAIN AND ITS ENVELOPES.

DISEASES OF THE BRAIN.

In connection with a surgical practice, congenital and acquired abnormal conditions of the brain are constantly encountered and must be differentiated one from the other. In a chapter like the present one, no attempt at an exhaustive exposition of these conditions can be made. The literature of each disease is so extensive that an apology is due for the many omissions and defects which a condensed resumé of the entire subject must of necessity exhibit.

The abnormal surgical conditions of the brain must first be classified in order to simplify the descriptive text which is to follow. The table offered is in many ways imperfect and perhaps not the best that can be made, but it may assist the reader in the study of subsequent pages.

A TABLE OF THE MORE IMPORTANT ABNORMAL CONDITIONS OF THE BRAIN.

- (1.) CONGENITAL ABNORMALITIES OF THE HEAD OR ITS CONTENTS.
  - Double-Head or Fusion of two heads.
  - Absence of the Brain or Head.
  - Cyclocephalic deformity.
  - Abnormalities of the Cerebral Envelopes.
  - Incomplete development of special ganglia.
  - Hydrocephalus.
  - Encephalocele.
- (2.) DISEASED CONDITIONS OF THE VASCULAR APPARATUS.
  - Aneurismal dilatations.
  - Atheroma.
  - Rupture or Spontaneous perforation—Apoplexy.
  - Thrombosis—Arterial or Venous.
  - Embolism.
- (3.) INFLAMMATORY CONDITIONS.
  - Fibroid degeneration.
  - Inflammatory changes.
  - Pachymeningitis (inflammation of the dura mater).
  - Arachnitis.
  - Hydrocephalus.
  - Cerebritis or Encephalitis.
- (4.) DEGENERATIONS.
  - Softening. { Red. White. Yellow.
  - Sclerosis.
  - Atrophy.
- (5.) NEW GROWTHS.
  - Carcinoma.
  - Epithelioma.
  - Glioma.
  - Myxoma.
  - Gummata.
  - Psammoma.
  - Cholesteatoma.
  - Tubercle.
  - Fibrous and Fibro-plastic.

Before we pass to a special consideration of the diseased conditions of the brain, it may be well to refer to a few special *symptoms* (some of which are often erroneously spoken of as diseases) that result from impairment of the functions of certain nerve centres. The more important of these are as follows:

MOTOR PARALYSIS—which can vary both in degree and type.
SENSORY PARALYSIS— " " " " " " " "
APHASIA.
IMPAIRMENT OF INTELLECT, MEMORY, CONSCIOUSNESS, ETC.
PAIN.
ABNORMAL ELECTRO-MUSCULAR PHENOMENA.
ABNORMAL CONDITIONS OF THE ORGANS OF SPECIAL SENSE.

We are enabled chiefly by a careful study of these symptoms to determine the existence of many of the diseases which have been enumerated; and to decide often as to the *location and extent* of the diseased conditions of the nerve centres that produce them.

The art of localizing lesions of the brain and spinal cord is based upon anatomical and physiological facts which are too complex to be given here in detail—a deficiency which the Author has endeavored to supply in a work devoted exclusively to that subject. (See bibliography.)

Some statements made in the pages which follow will be, of necessity, somewhat dogmatic, because the limits of this volume will preclude lengthy explanations. A few will possibly be open to criticism, because the data from which the conclusions have been drawn are not yet accepted as proven by all neurologists.

I have intentionally omitted in the preceding table certain conditions of the brain which have been made, of late, the subjects of frequent literary discussions. Among these may be mentioned the much disputed ground of cerebral hyperæmia and anæmia. In explanation, I can only say that in my opinion they are not within the special province of Surgery. They are now treated of in most of the later works upon the Practice of Medicine, and still more exhaustively in the various treatises upon Nervous Diseases.

CONGENITAL MALFORMATIONS OF THE BRAIN.

Two heads have been repeatedly met with on the same body. They may be distinct; or joined together either laterally or posteriorly. They may be also of different sizes and shapes, and may evidence different degrees of development.

An entire absence of the brain at birth, and, in some instances, of the spinal cord in part, has been not infrequently recorded. The cerebrum, cerebellum, pons Varolii, medulla oblongata, and even a part of the spinal cord may be occasionally wanting, and yet the cranial nerves may be perfectly developed. In rare instances, the base of the skull has been exposed to view; in others, the upper cranial bones have been wanting and the integumentary covering of the head has been found to be distended by a fluid accumulation beneath it; while, in some cases, only parts of the brain have been absent, the remaining ganglia being normally developed.

The condition termed "*Cyclocephalous*"—due to a fusion of the two orbits into one cavity—is sometimes encountered.

The meninges may be occasionally found to be incomplete. The corpus callosum, fornix, and septum lucidum have been found wanting. The optic nerves have sometimes no commissure. The whole brain may be occasionally so small as to constitute the "*microcephalous state.*" Again, only certain convolutions may exhibit arrested development, and a cyst filled with serum is then found to spring from the meninges and fill the space thus left vacant. The two hemispheres of the cerebrum may present extreme variation in point of size and weight; and the thalami and corpora striata may occasionally exhibit atrophy.

Finally the "*hydrocephalic condition*" may exist (characterized by excessive fluid outside of or within the ventricles of the brain). It usually tends to increase after birth. The brain may occasionally protrude from the cavity of the cranium at the various sutures or fontanelles—constituting "*encephalocele.*"

The various types of congenital malformations of the nerve centres which are encountered seem to depend upon some violence to the uterus, or mental shock to the mother during pregnancy.

DISEASED CONDITIONS OF THE CEREBRAL VASCULAR APPARATUS.

Under this heading come aneurismal dilatations; atheromatous and calcareous changes; rupture or spontaneous perforation of blood-vessels; thrombosis of arteries or sinuses; embolism; fibroid degeneration; inflammatory changes in the coats of blood-vessels; hyperæmia; and anæmia.

A. Aneurismal Dilatations. The vessels most frequently affected are the internal carotid, basilar, and middle cerebral. Within the

cavernous sinus, large aneurismal tumors are not uncommon. It must not be supposed, however, that the smaller vessels of the brain are exempt. Miliary aneurisms, which give to an artery and its branches an appearance resembling a bunch of grapes, frequently affect the vessels that form the circle of Willis and even those of the pia mater within the substance of the brain and in the ventricles. The small vessels which nourish the corpora striata and the optic thalami are sometimes affected.

Miliary aneurisms frequently coexist with aneurismal tumors outside of the cranium; but they seem to exhibit an independence of atheroma which is quite remarkable.

Charcot, Zenker, Bouchard, Meynert, Hammond, and others who have devoted special attention to this subject, differ regarding the cause of these dilatations; some regarding them as due to a "sclerosis of the tunica intima" of the arterioles, while others believe that small "dissecting aneurisms" (page 7) first form on account of a rupture of the inner coat. When the external coat of such an aneurism ruptures, a cerebral hemorrhage ensues. The fact that this condition affects all ages (even children are not exempt) seems to point to an "aneurismal diathesis" as an exciting cause in some instances—the arterial coats exhibiting marked congenital defects in their construction. Among the other exciting causes of cerebral aneurism may be mentioned the cachexia of cancer; tuberculosis; uræmic poisoning; chronic alcoholism; lead poisoning; leucocythæmia; rheumatism; gout; syphilis; and general paralysis. The remarkable tendency of alcohol to excite aneurismal tendencies (not only in the brain and retina but in other parts as well) is adduced by some authors as an argument in favor of the view that arterio-sclerosis precedes and causes the alterations in the calibre of the vessels.

These miliary aneurisms give rise not infrequently to headache and vertigo; and attacks of paralysis which follow one another rapidly, and from which the patient quickly recovers, are almost a positive proof of their existence.

In the case of aneurisms of large size, atheromatous or calcareous changes within the arterial coats are seldom absent.

B. ATHEROMA. This subject is treated of in a preceding chapter. (Page 4.) It is, perhaps, one of the most common causes of arterial thrombosis, and a frequent one of apoplexy.

C. SPONTANEOUS PERFORATION OF VESSELS. In rare instances, a

spontaneous perforation of a vessel within the cranium occurs without any appreciable cause being discovered. These localized changes in the walls of arteries are not well understood, but syphilis seems, as a rule, to be associated with spontaneous perforation.

D. CEREBRAL THROMBOSIS. A coagulum of blood may form in either the sinuses, veins, or arteries of the brain. The causes which chiefly tend to produce this result are (1) *atheroma*, which produces a roughened condition of the internal coat of the blood-vessels; (2) *hyperinosis*—or that condition of the blood in which a marked excess of fibrine is present, as in some acute diseases, of which inflammatory rheumatism stands foremost; (3) *pressure upon some large vessel or sinus*, so that the circulation within it is rendered extremely slow; (4) *chronic interstitial nephritis;* (5) *syphilis;* and (6) *pyæmia*, which seems to be associated with a special tendency toward spontaneous coagulation of blood within the vessels, when the rapidity of the current is slowed.

Thrombosis is much less common in arteries than in venous channels, but it is not uncommon in the internal carotid, the vertebral, the basilar, and the middle cerebral arteries. In the superior longitudinal and lateral sinuses, thrombosis is frequently found in connection with pachymeningitis. Old age seems to predispose to the development of cerebral thrombosis; and males are more commonly affected than females.

The effect of thrombosis of arteries or veins within the cavity of the cranium is to render the nutrition of surrounding parts more or less imperfect, and thus to impair the function of those parts. If it be of pyæmic origin, the clot may cause *suppuration* of the adjacent structures; and, by its disintegration, other vessels more or less distant from the seat of the original thrombus may become plugged by the detritus.

The symptoms produced by cerebral thrombosis must, of necessity, be modified by the situation of the clot and the vessel occluded by it. A knowledge of the *functions of different portions of the brain* can alone decide questions which may arise respecting the situation and the probable termination of the lesion. Either coma or paralysis (in any of its forms) is apt to be one of the results. The more common symptoms of this condition will be given in a table of contrast on a subsequent page. It is liable to be confounded chiefly with cerebral embolism or cerebral hemorrhage.

It must be remembered that syphilis and chronic nephritis are

among the most frequent of the causes of arterial thrombosis. This fact is explained by the development of an inflammatory condition of the internal coat of the vessel—the so-called "endarteritis obliterans." For this reason, the history of the patient may prove an important factor in the differentiation between cerebral thrombosis and some other conditions of the brain which might be mistaken for it.

E. CEREBRAL EMBOLISM. Most of the clinical facts which pertain to this condition in general have been mentioned in a previous chapter (page 15).

The most frequent seat of cerebral embolism is in the middle cerebral artery of the left side, because this artery forms the termination of the *most direct channel* from the heart. The left carotid is so situated in reference to the aorta as to favor the passage of floating particles in the blood into its mouth.

Next in point of frequency comes the right Sylvian artery, because the innominate artery, although larger than the left carotid, leaves the aorta at an angle opposed to the current of blood in that vessel.

Floating particles in the circulation (which become emboli within the vessels of the brain) may spring (1) from the *heart cavities* or from the *mitral* and *aortic* valves; (2) from the *walls of the aorta*; (3) from the *cavity of some aneurism*; (4) from the *disintegration of some thrombus* in other parts of the body (the loosened particles being swept into the circulation); and (5) from *foreign bodies* introduced into the circulation from without.

The *size* and *number* of the floating particles modify the seat and number of the emboli. If small, the capillaries of the brain alone may be occluded; if large, one or more of the main trunks are liable to be plugged, and a much larger area of brain substance is thus deprived of blood. Not infrequently many vessels are simultaneously obstructed at the same time. Sometimes all the main vessels on one side, and at other times vessels of both sides are more or less occluded.

The common effects of occlusion of a large trunk are *sudden aphasia* and *hemiplegia* (usually of the right side of the body). When the capillaries alone are involved and the main trunks escape, the effects and symptoms vary with the seat of the embolus, because only certain limited portions of the brain are then deprived of their nutrition.

Cerebral embolism is a constant source of *extravasation of blood*, because it induces infarction. It may result in localized softening

of the parts that are imperfectly nourished, provided the embolus is large. If the embolus is of suppurative origin, "embolic abscess" results.

An *infarction* is a wedge-shaped spot of consolidation and discoloration within an organ dependent upon occlusion of a blood-vessel and the subsequent rupture of neighboring capillaries. Whenever a vessel of an organ becomes occluded, the parts nourished by the occluded vessel are deprived of blood, until a collateral circulation is established. Now, it is found that, after such occlusion, the parts which are at first deprived of blood become subsequently the seat of a rupture of the *capillary blood-vessels* as the result of an excessive pressure produced by the collateral fluxion. Hence the infarction is wedge-shaped, as a rule, owing to the distribution of the blood-vessels; and its apex (corresponding to the seat of the plug) usually points toward the centre of the organ in which it is detected. If the circulation is not speedily restored, the result of defective nutrition caused by the embolus is evidenced in one of three ways: either in *gangrene*—if the part be totally cut off from its blood supply; *fatty degeneration* and *absorption* of the embolus and blood coagula—if the nutrition be only partially cut off; or more or less extensive *suppuration*—if the plug in the vessel be derived from a suppurative focus or be septic in its origin. We usually find, therefore, that old infarctions are liable to appear pale, and to be firm and incompletely organized, provided that the character of the plug (an embolus or thrombus) does not create suppuration; in which case disintegration takes place rapidly in the centre of the infarction, and an abscess results—"embolic abscess."

The more complete the obstruction, the more vascular the tissue, and the less the vessels are supported, the greater is the amount of infarction and the more rapid the softening and disintegration that ensues. The development of "*metastatic*" or "*embolic abscesses*" is one of the distinctive pathological features of pyæmia, and no case can be properly so called when these abscesses are not found after death.

For some unexplained reason the female sex is more frequently affected with cerebral embolism than the male sex. It is also more common in youth and adult life than in old age. The diagnostic points of cerebral embolism are enumerated in a previous table (page 44).

INFLAMMATORY CONDITIONS OF THE BRAIN AND ITS ENVELOPES.

In a previous chapter the subject of inflammation has been discussed. The more common conditions of this type which the surgeon encounters within the cranium are pachymeningitis; arachnitis; hydrocephalus; and encephalitis.

A. PACHYMENINGITIS OR INFLAMMATION OF THE DURA MATER. This condition is usually circumscribed and rarely spreads over the whole convexity of the brain. It is of two forms, the suppurative and the non-suppurative. As it is frequently associated with extravasation of blood, it is described by some authors under the name of "hæmatoma of the dura mater." Other authors classify it as of two forms, the external and the internal—the latter being sanguineous.

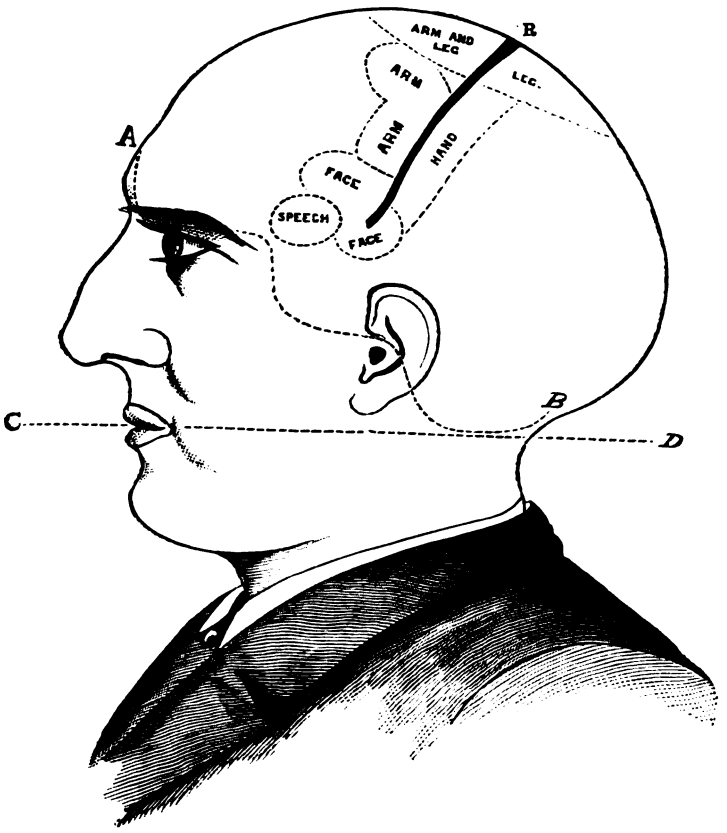
The causes which tend to produce it are as follows: (1) Injuries to the cranial vault; (2) Syphilitic disease of the bones of the cranium—most commonly of the temporal; (3) Hemorrhage between the dura mater and the bone; (4) Diseases of the cervical vertebræ and their ligaments.

Suppuration more commonly accompanies the carious and hemorrhagic varieties. It may occur after traumatism, especially if thrombosis follows. A general arachnitis is then liable to be induced as a complication of the circumscribed inflammation of the dura. The base of the brain is usually exempt from this form of meningitis, except as a sequel of traumatism, tumors, or diseases of the vertebræ.

In the non-suppurative variety, the dura becomes composed of superimposed layers which are rich in vessels. It subsequently becomes united to the arachnoid. These layers occasionally ossify. The newly formed vessels sometimes rupture and thus create circumscribed sanguineous cysts. When syphilitic caries is the exciting cause, the dura may become gangrenous.

Lesions of this character may excite paralysis of parts supplied by cranial nerves which lie adjacent to them; and when the pressure becomes extreme even coma may follow. Localized pain is usually present over the seat of the disease; and percussion of the skull over the lesion tends, as a rule, to increase the pain. The defective blood-supply (in those convolutions of the brain which lie adjacent to the lesion) that ensues from pressure upon them, may

PLATE XXI.



A DIAGRAM DESIGNED BY THE AUTHOR TO SHOW THE RELATIVE DEPTHS OF THE CRANIAL CAVITY AND THE SITUATION OF THE MORE IMPORTANT MOTOR CENTRES IN THE CEREBRAL CONVOLUTIONS. A—B. Outline of the floor of the cranial cavity, showing the *anterior*, *middle* and *posterior fossæ* of the cranium. B, *fissure of Rolando*. The upper limit of this fissure lies 45 millimetres (1 4-5 inches) posterior to a vertical line passing through the external opening of the ear when the patient is in the standing posture, and the head at a right angle to the spinal column. Its anterior or lower extremity lies nearly at the point of intersection of this vertical line (auriculo-bregmatic) and a horizontal line intersecting the upper level of the orbit. The auriculo-bregmatic line should be at a right angle to an imaginary base line (C—D), which corresponds to the *alveolo-condyloid* plane (that upon which a denuded skull naturally rests when upon a table, and with the lower jaw removed).

lead to softening. When suppuration occurs the symptoms are greatly aggravated. They are discussed in a subsequent page.

B. Arachnitis. Thickening and opacity of the arachnoid has been observed in connection with atheroma; cancer of the abdominal viscera; granular kidney; senile dementia; delirium tremens; tuberculosis; heart lesions; cerebro-spinal meningitis; hemorrhage into the pia mater; and as a sequel to disease of the bone and the dura mater.

It may be associated with an effusion of lymph or pus, and be either local or general. The exciting cause will be of the greatest aid in determining its character during life. It is often impossible to discriminate during life between lesions involving the dura mater from those of the arachnoid; and it is still more difficult to separate its morbid conditions from those of the adjacent pia mater which underlies it and which usually participates to a greater or less extent in its changes.

Atheromatous degeneration of the cerebral vessels seems to be commonly associated with those forms which have their apparent origin either in cancer or the abuse of alcohol. As in all inflammatory conditions of the coverings of the brain, the symptoms are produced either by the hyperæmia in the early stages, or by the pressure of the exudation upon the brain or cerebral thrombosis, in the later stages of the disease.

C. Hydrocephalus. The chronic form of this disease is essentially surgical, while the acute form comes more particularly under the province of the physician. In either case, however, the "tubercular diathesis" seems to influence its development. The chronic variety appears to be produced by a low grade of inflammation which attacks the *lining of the ventricles* during fœtal life or early childhood. In some instances it appears later in life, and in a few isolated cases the serous effusion seems to be external to the brain. Some authors state that this latter condition never occurs except as the result of a hemorrhage into the cavity of the arachnoid. They consider the condition which simulates true external hydrocephalus as an evidence either of a congenital defect in development (the cerebro-spinal fluid taking the place which the brain should have occupied), or of atrophy of the brain substance, that has resulted from the pressure of the fluid within the ventricles.

In chronic hydrocephalus the sutures fail to unite and the calvaria fails to ossify as in health; the ventricles are enormously

distended and the channels of communication between them are widely dilated and open; finally, the convolutions are flattened and the cerebral substance rendered extremely thin and attenuated. The ossa triquetra are often found to be excessive. A complicating meningitis (which often exists) may involve some of the cranial nerves (especially the optic) and induce atrophy of them. Fluctuation may usually be detected in the region of the fontanelles and the open sutures. The deformity of the cranium is evidenced by the overhanging brow, the increase of the circumference of the cranium and its disproportion to the size of the face, and the open fontanelles and unclosed sutures, which are often widely separated. The mental condition of the subject is below the normal standard when the pressure of the fluid has induced changes in the brain substance.

This condition may not in some cases materially shorten life; although, as a rule, it is fatal within a period extending from a few months to two or three years. If apparent recovery ensues, the intellect of the subject is always more or less impaired.

The symptoms of this condition will be found in a subsequent page, contrasted with those of other diseases with which it may be confounded.

D. ENCEPHALITIS. The substance of the brain may take on inflammatory action, with or without the existence of a complicating meningitis. It is generally circumscribed, although many spots may be simultaneously affected. The latter is sometimes termed the "general" variety. Sometimes the gray matter of the cortex is alone involved; again, only the medullary substance of the brain may be implicated; finally, the basal ganglia (the "corpora striata" and "optic thalami,") the cerebellum, the medulla oblongata, the pons Varolii, the crura cerebri, and the floor of the fourth ventricle have been known to be the seat of this condition.

The existence of encephalitis may be manifested after death (1) as spots of injection associated with abnormal friability; (2) by the presence of punctate extravasations seen on cross sections of its substance; (3) as localized indurations; (4) as red softening of the brain substance; (5) as circumscribed collections of pus; and (6) by gangrene.

If cerebral abscess has occurred, the cavity is usually encapsulated by a new connective-tissue formation.

Rindfleisch divides the stages of cerebral abscess as follows: 1. A stage of hyperæmia; 2. The development of infarction (page 467);

3. Œdema or hemorrhagic extravasation; 4. Proliferation of the cell-elements; 5. Hypertrophy and induration, in chronic cases; 6. Softening of the brain substance; 7. Suppuration; 8. A condition of fœtid suppuration, resembling gangrene, which is occasionally preceded by the development of a false membrane; 9. Atrophy, as a result of the inflammatory changes.

Among the causes of encephalitis which tend to induce suppuration may be mentioned pyæmic infarction; direct injury to the head; disease of the internal ear or temporal bone; diseases of the nasal cavity; syphilitic disease of the bones of the cranium; diseases of the orbit; cancer; and certain idiopathic causes which are not well understood.

Encephalitis is so closely allied to red cerebral softening that it will be further discussed under that heading. The symptoms of the disease must of necessity vary with the seat and extent of the lesion; hence it is difficult to interpret them correctly unless the functions and anatomy of the various component parts of the brain are well understood.

DEGENERATIONS OF THE BRAIN SUBSTANCE.

Under this head, we will consider (1) the three forms of cerebral softening; (2) sclerosis; and (3) atrophy.

A. Cerebral Softening. The three forms of this condition which are recognized by most authorities are the white, yellow, and red.

The *white variety* results from causes that tend to so impair the blood supply of the softened part as to deprive it of nutrition without creating at the same time a hemorrhage from the surrounding capillaries. It is often designated as the "non-inflammatory form," in contrast to the red, which is commonly of inflammatory origin.

The nature and mode of suppression of the blood supply, to portions of the brain more or less limited, governs to a great extent the variety of softening which results. As has been stated in a previous page, the arteries, capillaries, or sinuses of the brain may be independently occluded. Thrombosis or embolism may be the immediate cause of such occlusion, or the blood supply may be arrested by pressure upon the vessels from without, as in the case of hemorrhage, tumors, ligation, œdematous infiltration, etc.

The rapidity of arrest of the circulation, and the extent of collateral fluxion which immediately follows (within 24 or 48 hours), are the key-notes to the results which follow. The collateral cir-

culation may be sufficient in some cases to arrest the immediate death of the parts suddenly deprived of blood by an embolus or thrombus or some quickly developed and extreme pressure upon the blood-vessels. Again, it may be so great as to cause a capillary hemorrhage, giving the softened area a red appearance (*infarction*) immediately after the arrest of its normal blood supply. Finally, inflammatory action, as in true encephalitis, may create the red variety of softening.

The pathology of the three varieties of softening of the brain may be thus summarized:

The *white variety* is a chronic condition in the great majority of cases, and is usually dependent upon some disease of the small arteries and capillaries which *gradually* deprives the parts of their normal nutrition. There is no hyperæmia. The parts are usually of an opaque dirty white.

White softening may sometimes be acute, in which case it is due to a sudden obstruction of some *artery of large size* by an embolus or a thrombus.

The *yellow variety* is simply an altered state of either the white or the red. Its color is due either to the presence of altered blood-pigments which have arisen from a previous slight extravasation; or to a fine state of division and a close aggregation of particles of fat formed within a mass of the former variety.

The *red variety* is commonly an acute affection. As has been stated, it follows vascular occlusion from an embolus or thrombus; or it may be the result of an attack of encephalitis. A marked extravasation of blood into a mass of white softening may cause a red appearance to the mass, but the microscopical appearances will differ from that of the acute form now under consideration. In the red variety there is intense hyperæmia from the onset, followed by rupture of the capillaries and an extravasation of blood. Its pathology is similar to that of "infarction" elsewhere in the body (page 467).

The symptomatology of this affection will be discussed in a subsequent page, in contrast with that of others which must be *differentiated* from it. All forms of cerebral softening are liable to be accompanied by disturbances of motion and sensation, aphasia, and mental impairment. The seat and extent of the lesion will govern the type of its external manifestations; and the history of the patient will often be indispensable in deciding as to the existence of softening, if in the anterior part of the frontal, the occipital, or the temporal lobes, where the so-called "motor centres" of the brain are wanting (see plate).

B. SCLEROSIS OF THE BRAIN. The term "sclerosis" is used to designate a condition characterized by an increase in the connective tissue of an organ. This newly formed connective tissue subsequently contracts and induces atrophy of those parts which are thus subjected to pressure. This is because the blood supply is thus gradually diminished.

In the nerve centres this condition may assume different forms: 1. It may constitute the so-called "general sclerosis," seldom involving the brain but not infrequently affecting large tracts of the spinal cord. 2. It may be disseminated throughout the brain and spinal cord—constituting the "sclérose en plaques" of the French authors. 3. A variety of the second form, termed "miliary sclerosis," has also been described.

Sclerosis of the brain probably starts as a chronic congestion, which leads to an exudation of an albuminous fluid, and subsequently to cell-proliferation in the neuroglia. It is closely allied to inflammatory processes, if not strictly dependent upon them. Injuries to the convolutions of the so-called "motor area" of the brain seem to act as an exciting cause of a so-called "descending sclerosis" which confines itself to the tract of fibres that are functionally associated with the parts injured. In this way it eventually reaches the spinal cord. Similar changes may involve the cranial nerves, chiefly the optic. In chronic insanity, sclerosis of the brain is not infrequently detected. The same may be said of general paralysis; epilepsy; Duchennes malady; paresis; paralytic tremor; and idiocy.

The symptoms of this disease vary somewhat with the seat of the disease and its type, whether general or disseminated. It is to be confounded chiefly with cerebral softening, embolism, and thrombosis. In children, chorea might be mistaken for it. A table of differential diagnosis is given later, in which the main clinical features of this disease are presented.

C. CEREBRAL ATROPHY. This condition may be of two varieties—the infantile and senile.

In the *infantile form* the characteristic lesions include (1) obliquity of the skull—one lateral half being shrunken and deformed; (2) premature closure of the sutures; (3) atrophy of the corresponding cerebral hemisphere, involving its convolutions and basal ganglia. The atrophic changes may even involve the pedicles of the brain, the pyramids of the medulla, and the columns of the spinal cord. This form is due chiefly to fœtal apoplexy, encephalitis, hydrocephalus, and physical shocks or violent emotions on the part of the mother during pregnancy.

The symptoms of this variety vary with the extent of the atrophy. Weakness of intellect; deaf-mutism; abolition of some of the special senses; incomplete paralysis; contractures; and impairment of the sensibility of the paralyzed parts may be present in addition to the cranial deformity. The bones, muscles, nerves, etc., of the side opposite to the cerebral atrophy may be imperfectly developed. Ptosis and strabismus often occur.

In the *senile variety* the atrophic changes may be due to any cause which tends to slowly impair the nutrition of the brain. Among such may be mentioned embolism, thrombosis, hemorrhage, tumors, encephalitis, inflammations of the pia mater, alcoholic, opium, or lead poisoning, syphilis, etc.

The symptoms of this form include many manifestations of enfeebled mental powers. The memory and intelligence are affected early; apathy and somnolence develop; the power of motion is slowly but gradually lost; tremor makes its appearance; finally, the patients take to their beds and pass into the condition of childishness, accompanied by the symptoms of bulbar paralysis, from which they die. Bed sores, bronchitis, and acute pulmonary œdema are frequent complications.

TUMORS OF THE BRAIN AND ITS ENVELOPES.

The various forms of new growths which may be encountered in the brain have been enumerated in a tabulated form on pages 405 and 408. All of the attempts which have been made to classify tumors of the nervous system, from that of Jaccoud to the present day, are more or less illogical. Every classification must be open to some objection; but attempts of that kind unquestionably serve to assist memory and to systematize description.

We have already touched upon aneurisms as one of the lesions of the vascular apparatus. Parasites of the brain, which are enumerated by Jaccoud as a tumor, are discarded by Fox, because they can hardly be said to constitute a tumor. Exostoses have been discussed among the tumors of bone.

Among the entire list, gummata, or syphilitic tumors, possess more clinical interest than any of the others. This is because they are more frequent than the rest, and also because the prognosis is favorable—often after the most severe effects to the brain are manifested. We owe much of our knowledge of these lesions to Broadbent, who studied their effects upon the nerve centres. They start from the membranes or attack the surface of the brain directly.

They are strictly localized and grow slowly. They usually affect only small portions of the organ. Gradually, they tend to induce adhesions of the membranes both to each other and to the brain itself; and, by pressure, they cause local softening of the brain substance. In the same way, the effects of pressure upon the cranial nerves which lie adjacent to these tumors are often exhibited early; and thus the diagnostician is enabled to locate the tumor. This statement applies, however, with equal force to all tumors of the brain.

Tumors of the brain, and in fact any lesion which tends slowly to increase intra-cranial pressure, tend to manifest their existence by development of a double optic neuritis—the so-called "*choked disc.*"

This condition is only apparent when the ophthalmoscope is employed, but it possesses a decided clinical value. I have described the condition in detail in another work, from which I quote as follows:

"When the radiating fibres of the internal capsule are involved in a lesion which creates a gradually increasing pressure (as in the case of tumors which grow slowly) the *fundus of the eye* exhibits morbid changes in the region of entrance of the optic nerve which are of value in diagnosis. The condition so produced is commonly known as the 'choked disc.' It is nearly always bilateral, but often most marked in one eye. It may be considered as one of the most positive signs of an extensive intra-cerebral lesion, and especially of tumors of the brain. When the eye is examined with an ophthalmoscope, this condition is characterized by a swollen appearance of the optic nerve, which projects appreciably above the level of the surrounding retina; the margin of the disc is either obscured or entirely lost; the arteries appear small, and the veins large and tortuous; finally, small hemorrhagic spots may often be detected in the retina near the margins of the disc. In spite of this condition, the power of vision may be little impaired; so that the existence of 'choked disc' may be unsuspected unless the ophthalmoscope be used before the diagnosis is considered final. After a number of weeks, and very much longer if a tumor is the exciting cause of the condition, the appearance of the disc changes. An unnatural bluish white color, which denotes atrophic changes, develops; the outline of the disc becomes sharply defined; the retinal vessels become small; and vision becomes markedly interfered with."

Tumors of the brain are to be differentiated chiefly from meningitis; encephalitis; cerebral softening; slight cerebral hemorrhage;

cerebral abscess; thrombosis; and embolism. A table of differential diagnosis is given later, which will help to make the chief points in the symptomatology of cerebral tumors clear; although it is impossible to make general statements in reference to brain lesions to which exceptions will not frequently occur.

SPECIAL SYMPTOMS INDICATIVE OF BRAIN LESIONS.

Before we pass to the consideration of the tables of differential diagnosis of the various conditions of the brain, which have been described in previous pages, let us consider, a little more in detail, some of the symptoms which have been enumerated on a preceding page as possessing a peculiar diagnostic importance.

MOTOR PARALYSIS.

Anything which tends to impair the generating power of nerve-centres or the conducting power of nerve-fibres may produce paralysis of motion or sensation.

Motor paralysis can result, therefore, from any cause which interferes with the motor convolutions of the brain, or the nerve-fibres which start from them and are continued as the so-called "motor tract." The latter pass through the following parts: (1) The white substance of the cerebral hemispheres; (2) the corpora striata; (3) the crura cerebri; (4) the pons Varolii; (5) the medulla oblongata; and (6) down the motor columns of the spinal cord.

The disturbing lesions may be therefore classified as: (1) Those of the gray matter of the convolutions of the brain (cortical lesions); (2) those of the central mass of the cerebral hemispheres, including lesions of the "internal capsule"; (3) those of the corpora striata; (4) those of the crura cerebri; (5) those of the pons Varolii; (6) those of the medulla oblongata; (7) those of the spinal cord.

The various tests which are employed to determine the existence and extent of a loss of muscular power will be found in all text-books upon nervous diseases.

Cortical Paralysis, or that form dependent upon some lesion of the gray matter of the cerebral convolutions (*the cerebral cortex*), may occur in connection with abscesses, blood-clots, spots of softening, tumors, depressed bone, periosteal and meningeal thickenings, embolism, thrombosis, etc.

The researches of Ferrier have lately taught us the situation of *special motor centres* scattered over the convolutions of the so-called

"motor area" of the cerebrum. From this standpoint we are often enabled to judge of the seat of the lesion by the aid of the groups of muscles which exhibit the paralytic state (*monoplegia*). Hughlings-Jackson and Brown-Séquard have added to our knowledge of the relative effects of destructive and irritative lesions of the cerebral cortex.

IRRITATIVE LESIONS are usually ushered in by convulsive attacks, which leave the subject paralyzed in some special group of muscles (*monoplegia*); or, if *hemiplegia* ensues, some parts of the body are more affected than others. The paralysis is usually transient and returns again after subsequent convulsive attacks. These irritative lesions are generally of syphilitic origin.

DESTRUCTIVE LESIONS of the cerebral cortex are characterized by paralysis of special groups of muscles, or *monoplegia*, as was the case with the irritative lesions. This is in marked contrast to the "hemiplegia," which follows lesions of the central portions of the nervous system. If the lesion be very extensive, coma may be produced, but *consciousness is not usually lost* unless the attack be accompanied by convulsions. *Pain* of a local character within the head is often complained of, and percussion over the seat of the lesion frequently elicits it, if it should be absent. The *sensibility* of the paralyzed parts is not impaired, unless more or less sensory paralysis exists as a complication. The paralyzed muscles exhibit the *normal electro-contractility*. As is the case with all cerebral lesions, the paralysis is developed on the side opposite to the exciting cause (except in very rare instances). The various types of monoplegia, and the surgical guides for trephining over special motor centres, have been discussed in the author's work upon the anatomy of the nervous system. Space will not allow of their repetition. In cortical lesions of the motor area the muscles frequently exhibit a *state of post-paralytic rigidity* in the *early stages* of the disease.

HEMIPLEGIA. This condition is characterized by a *paralysis of motion in one lateral half* of the body. It is often associated with more or less anæsthesia, but it may exist independently of it.

Hemiplegia may be produced by any lesion which interferes with the free action of the "*motor tract*" of fibres during their passage from the motor convolutions of the cerebrum to the columns of the spinal cord, and lesions even of the spinal cord itself (if sufficiently high up and restricted to that *lateral half of the cord* on the side which corresponds to the paralysis) may induce it.

If the lesion be within the cavity of the cranium, the hemiplegia will be on the opposite side of the body; if it be spinal, the hemiplegia will be upon the same side.

Hemiplegia from intra-cranial lesions may be the result of embolism, thrombosis, apoplexy, softening, abscess, tumors, compression of the brain from traumatic causes, destruction of limited portions by injury, general pressure from inflammatory exudations, etc.

Consciousness is generally lost when the hemiplegia is developed. *Convulsive attacks are not usually present* at the onset of the paralysis. The *paralysis is more profound*, as a rule, than that of cortical lesions, and of longer duration. The *special senses* are not infrequently involved to a greater or less degree. Other *cranial nerves*, which are not associated with the special senses, may also give evidence of being implicated by the lesion.

By these guides the seat and extent of the lesion may often be determined with positiveness. The *co-existence of impairment of sensation with motor paralysis* is a valuable diagnostic sign that the exciting lesion is within the substance of the brain and not upon its surface. The exceptions to this rule are extremely rare.

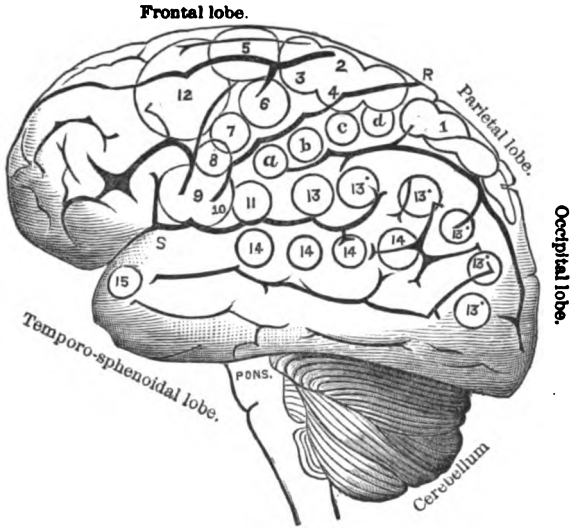
The localization of non-cortical lesions is more difficult and less certain than those which are confined to the cortex. A careful study of all the symptoms presented (when combined with accurate anatomical knowledge) will often, however, lead to most positive deductions. It should be remembered that accuracy of diagnosis often leads to success in treatment of disease, and in no case is it better exemplified than in the nerve-centres.

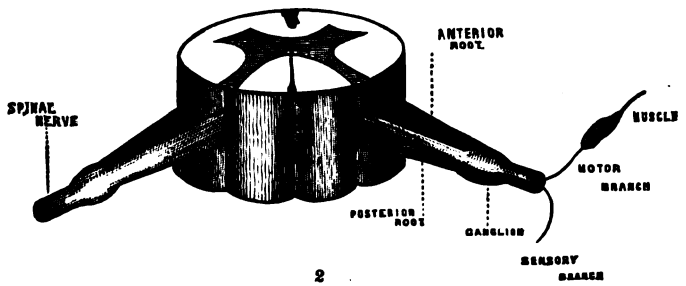
Crossed Paralysis. A condition in which the face or some organ of special sense gives evidence of an impairment of a cranial nerve, while the body is simultaneously rendered hemiplegic on the opposite side, is termed "crossed paralysis"—the "*paralysie alterne*" of the French authors. We owe much of our knowledge of this subject to Prof. Romberg, of Berlin, who has written extensively upon it.

The more common forms of crossed paralysis are named from the cranial nerve, which exhibits an impairment of its functions. They are as follows:

First	Cranial	Nerve	(olfactory)	and	body type.
Third	"	"	(motor oculi)	"	"
Fifth	"	"	(trigeminus)	"	"
Seventh	"	"	(facial)	"	"

PLATE XXII.





1. Side View of the Brain of Man and the Areas of the Cerebral Convolutions.

R, Fissure of Rolando. S, Fissure of Sylvius, dividing into its two branches.

1 (on the postero-parietal [superior parietal] lobule). Advance of the opposite hind-limb as in walking. 2, 3, 4 (around the upper extremity of the fissure of Rolando). Complex movements of the opposite leg and arm, and of the trunk, as in swimming; *a*, *b*, *c*, *d* (on the ascending parietal [posterior central] convolution), individual and combined movements of the fingers and wrist of the opposite hand; prehensile movements. 5 (at the posterior extremity of the superior frontal convolution). Extension forward of the opposite arm and hand. 6 (on the upper part of the antero-parietal or ascending frontal [anterior central] convolution). Supination and flexion of the opposite forearm. 7 (on the median portion of the same convolution). Retraction and elevation of the opposite angle of the mouth by means of the zygomatic muscles. 8 (lower down on the same convolution). Elevation of the ala nasi and upper lip with depression of the lower lip on the opposite side. 9, 10 (at the inferior extremity of the same convolution, Broca's convolution). Opening of the mouth with 9, protrusion, and 10, retraction of the tongue —region of aphasia, bilateral action. 11 (between 10 and the inferior extremity of the ascending parietal convolution). Retraction of the opposite angle of the month, the head turned slightly to one side. 12 (on the posterior portions of the superior and middle frontal convolutions). The eyes open widely, the pupils dilate, and the head and eyes turn toward the opposite side. 13, 13 (on the supra-marginal lobule and angular gyrus). The eyes move toward the opposite side with an upward 13, or downward 13' deviation; the pupils generally contracted (centre of vision). 14 (of the infra-marginal, or superior [first] temporo-sphenoidal convolution). Pricking of the opposite ear, the head and eyes turn to the opposite side, and the pupils dilate largely (centre of hearing). Ferrier, moreover, places the centres of taste and smell (15) at the extremity of the temporo-sphenoidal lobe, and that of touch in the gyrus uncinatus and hippocampus major.

A Spinal Segment. The two roots of each spinal nerve are shown; also the sensory and motor fibres of which each is composed.

The symptoms of these four varieties will be found by referring to subsequent pages, where they are arranged in the form of contrasted columns.

It may be well to remark in this connection that "crossed paralysis" is of special clinical importance, because it often imparts the most positive information to the surgeon in regard to the *seat of the lesion* which has produced it. These facts will also be found in the tables above referred to.

COMPLETE PARALYSIS. When a lesion is situated at the base of the brain, and is sufficiently large to involve the *motor tract of both hemispheres*, the body may be completely paralyzed below the head.

Various cranial nerves—chiefly the third, fifth, sixth, and seventh—are liable to then exhibit the effects of simultaneous pressure upon them; hence the general paralysis of the body is apt to be associated with paralytic symptoms confined to the face. Bilateral spinal lesions when situated high up in the cervical region may also cause this form of paralysis.

SENSORY PARALYSIS.

The sensation of special parts of the body may be so modified by lesions of the nerve-centres as to constitute a type of paralysis. The various forms of this condition may exist independently of motor paralysis or may coexist with it. The tests commonly employed to detect the limits and degree of sensory paralysis can be found by consulting the later text-books upon Nervous Diseases.

Sensory paralysis may be classified as follows:

(1.) Paralysis of those *cranial nerves* which are not endowed with motor attributes.

(2.) Paralysis of sensory nerves below the head. This subdivision comprises, *hemianæsthesia; general anæsthesia;* and *local anæsthesia.* The latter will be considered later, in connection with lesions of the spinal cord.

Among the various clinical evidences of lesions which affect the sensory nerve-tracts of the brain and spinal cord, the following may be mentioned:

Hyperæsthesia—or an excitation of sensibility.

Numbness.

Formication—or a sensation like the creeping of ants.

Abolition of Sensation—or complete anæsthesia. This condition may be general or local.

Anosmia and *Hemianopsia.*

Delayed Sensation—as is evidenced by a perceptible interval of time between the contact of a foreign body with the skin and its conscious appreciation by the patient when the eyes are closed. The pricking of the skin with a needle is a test commonly employed to determine this condition. It is clinically related to lesions of the spinal cord only.

Some of these conditions will be now considered in their more important aspects. Others will not be separately described, as they would require too much space, provided such a resumé was attempted.

HEMIANÆSTHESIA. This condition is characterized by a *loss only of sensation* (not of motion) in *one lateral half* of the body. It is often associated with more or less marked hemiplegia.

The tests employed to determine the existence of this state and its degrees of intensity are the same as those employed in any form of sensory paralysis.

Hemianæsthesia indicates that the exciting lesion has impaired the conducting power of the fibres associated with the so-called "*sensory area*" of the cerebral convolutions. There is strong clinical evidence to sustain the opinion that these fibres run in the *posterior third* of the "*internal capsule.*" Lesions of this latter region are not infrequently the cause also of more or less *impairment* of *sight, smell, hearing,* and *taste,* in addition to their effects upon general sensation. Charcot, Ferrier, Rendu, Raymond and others who have studied the effects of lesions of the posterior third of the internal capsule of the cerebrum concur in this statement.

Hemianæsthesia is frequently accompanied by the development of *choreiform movements* after the paralysis has developed. These may assume the type of athetosis, true ataxia, or tremor. The same may also be said of that type of hemiplegia which occurs as the result of lesions of the internal capsule of the cerebrum.

Finally, a condition characterized by an abnormality of the eyes, termed "*conjugate deviation*" may be associated with lesions of the white centre of the cerebral hemispheres. I quote an extract from my late paper upon the diagnosis of lesions of the internal capsule regarding this symptom :

"When, in connection with rapid softening or an extravasation of blood into the substance of the cerebrum above the level of the basal ganglia, this peculiar symptom is developed (either simul-

taneously with or following paralysis and coma), the patient's head and eyes will be observed to be *turned constantly away from the paralyzed side* and toward the side upon which the seat of the lesion is. Various attempts have been made by late authors to throw discredit upon the clinical significance of this symptom as particularly indicative of a lesion of the cerebral hemisphere, but I am convinced that it is a valuable differential sign. Ferrier has demonstrated that a cortical centre, which he locates in the first and second frontal gyri near to their bases, presides over conjugate movements of the head and eyes, and causes dilatation of the pupils. He attributes this symptom, when occurring in connection with hemiplegia of cortical or ganglionic origin, to the unantagonized action of the corresponding centre of the uninjured hemisphere, thus explaining the fact that the distortion is toward the side of the lesion. Clinical evidence of the correctness of this view has been brought forward by Hughlings-Jackson, Priestly Smith, Chouppe Landouzy, Carroll, and others; and, in some cases reported, the situation of the lesion has been verified by pathological observation. The opportunity to record pathological observations upon cases where this symptom was well marked during life is, unfortunately for science, a comparatively rare one. It is impossible, therefore, to speak positively concerning the diagnostic value of this symptom, although the weight of clinical evidence seems to be strongly in its favor."

Finally, it must be said that in *cerebral hemianæsthesia* there is more or less insensibility to touch, pain, and temperature, and also abolition of muscular sensibility with complete retention of electro-motor contractility. The mucous membranes of the eye, nose, and mouth are also anæsthetic.

NUMBNESS AND FORMICATION. In connection with sensory paralysis, a condition of numbness, which the patient describes as feeling as if some special part was "fast asleep," is often experienced. In others a sensation which has been compared to the "creeping of ants" over some special region is complained of. The latter has been termed "formication."

These abnormal sensations are confined exclusively to those parts to which the sensory nerves are more or less impaired; either after their escape from the brain or spinal cord or by lesions of the nerve-centres which involve their fibres of origin.

By a careful study of these symptoms, a skilled anatomist is often enabled to decide whether the lesion is cerebral, spinal, or

confined to special nerve-trunks. This field is too extensive, however, to be considered in detail here.

HYPERÆSTHESIA. In connection with lesions of the brain and spinal cord, a condition of excessive sensibility is sometimes encountered. It is termed "hyperæsthesia."

It may exist independently of motor or sensory paralysis; or, again, it may coexist with them. Its clinical significance depends upon its seat and extent, and the other evidences of disturbed nervous functions which coexist.

HEMIANOPSIA. A loss of vision in *one lateral half* of each retina is termed "hemianopsia" and "hemianopia." It is called "hemiopia" by some authors; although incorrectly so, as that term means "half-vision" while the two others mean what they are intended to express.

I quote from a late article of mine in regard to this condition, as follows:

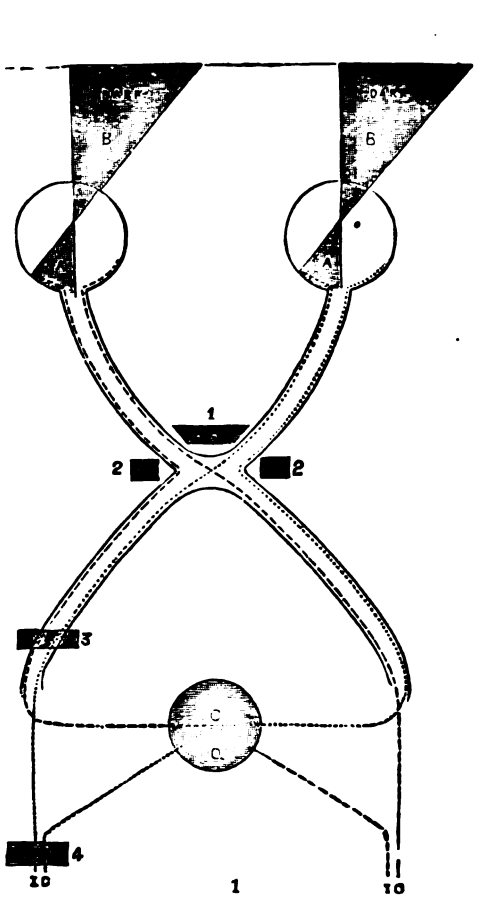
"The following steps are commonly employed to detect the existence of this symptom: Request the patient to close one eye by pressing the lid down with the finger, and to so direct the open eye as to concentrate its gaze upon some fixed object near to it. [I usually hold up the forefinger of my own hand within a foot of the patient's open eye, and tell him to look steadily at it.] Having done this, take some object which is easily seen (such as a sheet of white paper) in the unemployed hand, and move it to the right and left of the object upon which the patient is gazing, and also above and below the object, asking the patient, in each case, if the two objects are seen simultaneously and with distinctness, and notice upon which side of the fixed object the patient cannot perceive the moving object. It is self-evident that the retina is blind upon the side opposite to that upon which the moving object is lost to sight.

"The most common form of hemianopsia is that in which the *nasal half* of one eye and the *temporal half* of the other is blind; this condition being the result of pressure upon, or actual destruction of, one of the *optic tracts*.

"When the *chiasm* is affected, we meet the *bi-nasal* type.

"There is still one more form which is occasionally encountered, viz., the *bi-temporal* type. This has been interpreted by an autopsy made upon a case entrusted to the care of Professor H. Knapp, of this city. It must be evident that the chances would be extremely small of ever encountering a bi-lateral lesion which would affect

PLATE XXIII.



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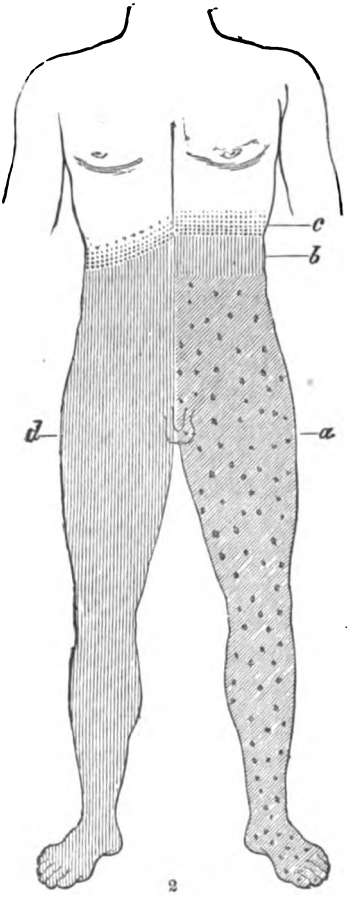

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3

1. Diagram explicative of hemiopia. The shaded intra- and extra-ocular parts, A and B, indicate the obscuration in right lateral (or homonymous) hemiopia, as caused by lesion 3, so placed as to destroy one optic tract. In that tract are two sets of nerve-fibres, one represented by a dotted line supplying the nasal half of right retina, the other fibres by a broken line supplying the outer or temporal half of the left eye. As visual lines cross in the eye the obscuration of the half fields is the opposite. Lesion No. 1, anterior to chiasm, produces blindness of inner half of each retina, and consequently bi-temporal hemiopia. Lesions No. 2, a pressing upon the sides of the chiasm, injure fibres supplying the temporal half of each retina, and cause bi-nasal hemiopia. C Q, corpus quadrigeminum, in which Professor Charcot believes a second partial decussation takes place. I C, internal capsule containing, on Charcot's hypothesis, all the fibres coming from the eye of the opposite side. 4. Lesion of internal capsule injuring all the fibres connected with the right retina, and causing amblyopia of the right eye.

2. Diagrammatic representation of the skin symptoms in unilateral lesion of the dorsal portion of the spinal cord on the left side. The diagonal shading (*a*) signifies motor and vaso-motor paralysis; the vertical shading (*d* and *b*) signifies anæsthesia of the skin; the dotted shading (*c*) indicates hyperæsthesia of the skin.

3. Localization of the diseased area in the anterior horns of the lumbar enlargement of the cord in a child two years old, eleven months after the beginning of the disease. A larger area of softening in the right, a smaller one in the left anterior column; 13, 20, 30, 36 and 43 mm. above the termination of the cord.

only those fibres of the optic chiasm, or optic tract, which supply the temporal half of each retina, and, at the same time leave the decussating fibres intact. How, then, are we to account for the fact that this form is sometimes met with? In the preceding portion of this article I have called attention to a peculiar arrangement of the arteries in the region of the optic chiasm. Now, it has been shown that atheromatous degeneration of the 'circle of Willis' (a peculiar arrangement of blood-vessels at the base of the brain) so impairs the elasticity of the arteries as to create a type of injury to the chiasm, so limited in its extent as to impair only the fibres distributed to the temporal halves of the retinæ, and thus to create bi-temporal hemianopsia.

"We may, therefore, summarize the clinical significance of this peculiar form of blindness as follows:

"(*a.*) The *homonymous* or *crossed variety* indicates lesions affecting the optic tract.

"(*b.*) The *bi-nasal variety* indicates a lesion pressing upon the central portion of the chiasm.

"(*c.*) The *bi-temporal variety* indicates atheromatous degeneration of the circle of Willis. Possibly (?) symmetrical lesions of the outer part of the chiasm might also cause it. I am not aware that the view of Charcot, that a decussation of the optic fibres takes place within the substance of the corpora quadrigemina, is as yet sustained by a recorded case of bi-temporal hemianopsia produced by a circumscribed lesion within the optic lobes.

"(*d.*) Finally, lesions of the *internal capsule* are often associated with *amblyopia*, or indistinct vision confined to one eye."

APHASIA.

An impairment of the *idea of language* or *its expression* (independent of paralysis of the tongue) constitutes this condition.

It is commonly described as of two varieties; the "*amnesic*," in which the memory of words is more or less effaced; and the "*ataxic*," in which the memory of words is perfect but the subject cannot properly pronounce them, from an inability to perfectly coördinate the muscles concerned in articulation.

The symptoms of this malady in either of its forms are always of great clinical interest; because some peculiarity in each case causes

it to differ from others which may have been previously encountered

In the *amnesic variety*, the most familiar objects are commonly mis-named; the subject being oftentimes aware that the error has been committed and yet is not able to correct it. The form which this loss of memory takes is liable to vary with each case. As an illustration of this, some forget only names; others only numbers. In certain reported cases, the names of things only in dead or foreign languages were retained; in others, the reverse has been observed, the patient losing all memory of acquired tongues. Again, the sound of words often will not be recognized, when the letters which form them will; and the reverse of this condition is not infrequently met with in aphasic subjects.

We owe to Broca the credit of the discovery that the *centre of articulate speech* could be located in the posterior portion or base of the *third frontal convolution*, and to many of the later pathologists the debt of overthrowing what once was the popular view, viz., that this centre is not confined exclusively to the left cerebral hemisphere. Subsequent pathological observation seems to have added strength to the view that lesions of the "*island of Reil*," as well as the *medullary substance* which intervenes between it and the centre of Broca, must be included in the so-called "speech area;" and that the amnesic form may be dependent likewise upon lesions of the so-called "sensory area" of the brain seems probable, although the limits of the speech centre are not yet defined with accuracy.

The "centre of Broca" is supplied with blood by the middle cerebral artery. An embolus within that vessel will tend, therefore, to arrest the circulation of that important area; and, at the same time, will interfere more or less with the nutrition of the corpus striatum—the ganglion which probably controls all motor impulses sent out from the brain to the muscles of the opposite side of the body. Now we know clinically that embolism is a frequent cause of aphasia, and that hemiplegia almost always accompanies it. We also know that the middle cerebral artery of the left side is the most frequent seat of embolic obstruction. This fact helps us to interpret the development of *right hemiplegia* in connection with aphasia, as is found to exist in the large proportion of such cases. Seguin found two hundred and forty-three cases in which right hemiplegia existed out of a total of two hundred and sixty—left hemiplegia being present in but seventeen cases.

In the *ataxia variety* of aphasia the patient can usually write what cannot be spoken, thus proving that the memory of words is not

effaced, but rather the ability to so coördinate the muscles of speech as to properly pronounce them. This condition must not be confounded with aphonia (loss of voice). Several cases have been reported where the amnesic form has given place to the ataxic, and the lesion has been found over the centre of Broca. It would seem, therefore, that the third frontal convolution (although placed in close relationship with the oral and lingual centres by Ferrier) has some connection with the memory of words as well as the simple apparatus of speech.

Cases of aphasia should be subjected to a variety of tests, which will tend to bring out the special peculiarities of each.

If lesions of the cerebral cortex exist as the exciting cause of the aphasia, convulsions may be associated with its development. The explanation of this symptom is given on page 477. If numbness or anæsthesia coexist with hemiplegia and aphasia, it indicates that the "motor and sensory tracts" are involved, as well as the centre of speech.

PRACTICAL, CLINICAL, AND PHYSIOLOGICAL DEDUCTIONS,

OFFERED AS A GENERAL SUMMARY OF THE MAIN POINTS IN THE LOCALIZATION OF LESIONS OF THE BRAIN AND SOME OF ITS NERVES.

In closing this chapter it has been deemed advisable to attempt the somewhat difficult feat of presenting in condensed paragraphs the more important points in the diagnosis of lesions which impair the free action of the brain or the cranial nerves. Should the preceding pages fail to cover any of the subjects embraced in this resumé, the reader is referred to the author's more complete work, that deals exclusively with the nervous system. (See Bibliography.)

Many imperfections are necessarily entailed when an abbreviation of such a complex subject is stripped of all explanatory text. Space precludes, however, more than a simple statement of a few clinical facts which the later investigations (respecting the nerve-centres and the cranial nerves) have placed upon a footing worthy of credence.

In this summary the various guides afforded by the *cranial nerves* will be considered first. Subsequently lesions of *separate parts of the brain* will be reviewed. Some of this matter has been published previously by the author in various medical journals.

LESIONS AFFECTING THE OLFACTORY NERVE.

1. ANOSMIA (loss of smell) may occur from any lesion which involves the first cranial nerve. It is usually unilateral. If it occurs in connection with hemiplegia, the body paralysis is on the side opposite to, and the anosmia on the same side as the lesion (page 478). It indicates a lesion *situated in the anterior fossa of the cranium.*

2. CROSSED PARALYSIS of the "olfactory nerve and body type" indicates a localized pressure which is chiefly exerted upon parts *within the anterior fossa of the skull.* The motor tract is probably involved by upward pressure upon the caudate or lenticular nucleus, or the fibres of the internal capsule; thus accounting for the hemiplegia of the opposite half of the body. The olfactory nerve, which lies near to the optic chiasm, is affected by pressure in the downward direction, and the optic chiasm or tract may be simultaneously involved; hence, a loss of smell in the nostril on the same side as the lesion may coexist with some form of hemianopsia, as well as with a crossed hemiplegia.

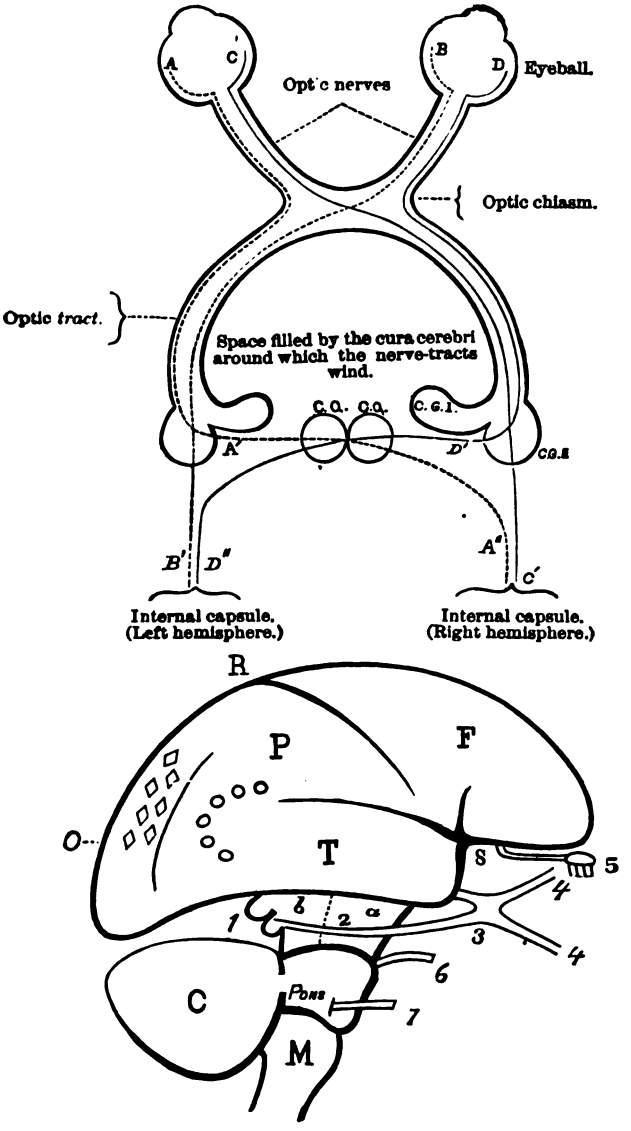
LESIONS AFFECTING THE OPTIC NERVE.

1. AMBLYOPIA of one eye may result from lesions involving the optic nerve *in front of the chiasm,* or from *lesions of the "internal capsule" of the cerebrum.* If from the latter, the field for color-perceptions will be found to be markedly contracted, or color-vision will be wanting; both eyes may be affected, the most marked changes being found, however, in the eye opposite to the seat of the lesion. We have not sufficient data for positive clinical deductions respecting lesions of the "visual area of the cortex" in man. The blindness of the opposite eye appears to be absolute, while it lasts, in all animals upon whom the visual area has been destroyed.

2. HEMIANOPSIA only occurs when the *optic tracts* or the *optic chiasm* are pressed upon or destroyed by lesions in the region of the base of the cerebrum. It is evident, therefore, that the trephine cannot afford relief of this symptom. When syphilitic gummata may be suspected, the prognosis is extremely favorable if active treatment be employed. The variety of hemianopsia indicates the seat of the lesion with great exactness (see page 482).

If *paralysis* (in any of its forms) coexist with hemianopsia, a valu-

PLATE XXIV.



A DIAGRAM DESIGNED BY THE AUTHOR TO SHOW THE COURSE OF FIBRES WITHIN THE OPTIC NERVES, AND SOME OF THE MORE IMPORTANT RELATONS OF THE SAME. A, A', A'', and D, D', D'', fibres which do not cross at the chiasm, but probably do at the corpora quadrigemina (C, Q). C, C', and B, B', fibres which do decussate at the chiasm. The relations of these fibres to the "internal capsule" of the cerebrum is also shown. This portion of the cerebral hemisphere is shown to be in relation with the fibres distributed only to the opposite eye; hence, lesions within it tend to produce "crossed amblyopia." The relation of bundles within the chiasm is made apparent. The fibres of the chiasm which connect the two eyes directly (inter-retinal fibres), and those which connect the two cerebral hemispheres directly (inter-cerebral fibres), are not shown, because they have no bearing upon symptoms, even if their existence is to be considered as demonstrated. C, G, I, internal geniculate body. C, G, E, external geniculate body.

A DIAGRAM DESIGNED TO SHOW SOME OF THE RELATIONS OF THE OPTIC NERVE-FIBRES TO SURROUNDING PARTS. F, frontal lobes of cerebrum; P, parietal lobe; T, temporo-sphenoidal lobe; S, fissure of Sylvius; R, fissure of Rolando; O, occipital lobe; C, cerebellum; M, medulla oblongata. 1. Corpora quadrigemina. 2. Optic tracts. 3. Optic chiasm. 4. Optic nerves. 5. Olfactory nerve. 6. Motor-oculi nerve. 7. Trigeminus nerve. *a*, basis cruris; *b*, tegmentum cruris. The circles in the parietal lobe represent the *cortical visual centres of Ferrier;* the diamonds in the occipital lobe, the *cortical visual centres of Munk.* The cerebellum and pons Varolii are shown as if separated from the cerebrum, in order to make the relations of the crus to the optic tracts apparent.

able guide will often be afforded in determining the extent of the lesion.

The bi-nasal, and also the bi-temporal varieties, are due (as a rule, at least) to lesions confined to the *anterior fossa* of the cranium; hence we sometimes find the *olfactory nerve* of the side corresponding to the seat of the lesion simultaneously affected, and creating anosmia (loss of smell) with or without subjective odors.

If the lesion be situated within the *middle fossa* of the cranium, the *optic tracts* will be affected, thus causing crossed hemianopsia; while the *motor nerves of the eye* may be simultaneously pressed upon, as they pass through that fossa on the way to their foramen of exit from the cranium (the sphenoidal fissure), thus producing more or less impairment of the movements of the eyeball of the same side. The value of these complications cannot be over-estimated, when they exist, because they are of the greatest aid in diagnosis, and often enable the skilled anatomist to positively determine the seat of the lesion.

Hemiplegia may occur in connection with hemianopsia; provided that the lesion is of sufficient size to affect any part of the so-called "*motor tract*" simultaneously with the optic nerve-fibres. The motor paralysis is on the side opposite to the lesion, because the fibres of the motor tract decussate at the lower part of the medulla. Flechsig has shown that, in rare cases, *exceptions* to this general rule are to be explained by an abnormality in the decussation of the motor fibres. Hemiplegia is seldom observed in connection with hemianopsia alone, since the olfactory, motor oculi, trigeminus, and facial nerve-roots are especially liable to be simultaneously involved. This explains the mechanism of the four varieties of "crossed paralysis" which are encountered, the hemiplegia being on the side opposite to the lesion, and the symptoms produced by paralysis of the cranial nerve being confined to the side corresponding to the lesion.

Ataxic manifestations, occurring in connection with evidences of impairment of the sense of sight, open a wide field for speculation. The proximity and intimate structural relations of the cerebellum with the optic lobes, basal ganglia, crus, and medulla, suggest the possibility of cerebellar lesions when these two symptoms are present to a marked degree.

Hemianæsthesia indicates some disturbance of the nerve-fibres of the so-called "sensory tract"; the loss of sensation being confined to the lateral half of the body opposite to the lesion which causes it, because the sensory fibres decussate in the spinal cord.

In *cerebral hemianæsthesia* there is more or less insensibility to touch, pain, and temperature, and also abolition of muscular sensibility with complete retention of electro-motor contractility. The mucous membranes of the eye, nose, and mouth are also anæsthetic. Now the upper portion of the sensory tract lies in the posterior regions of the crus cerebri and the internal capsule, and is in close relation with the posterior basal ganglia. The fibres of the optic tract may be likewise affected simultaneously with lesions of the following parts: the crus, the internal capsule, the optic thalamus, the corpora quadrigemina, the geniculate bodies, and the medulla. It has been already stated that lesions of the internal capsule are often associated with *amblyopia*, but not with hemianopsia. Our ability to definitely locate lesions of the sensory tract, or of the ganglia connected with it, is, as yet, imperfect. It is only by the careful study of associated symptoms that conclusions can be arrived at.

Crossed paralysis of the "motor oculi nerve and body" type indicates a *lesion situated within the crus cerebri*. If *hemianopsia* be present in connection with this condition, it proves conclusively that the optic tract, which lies in close relation with the crus, is simultaneously affected by the lesion. The symptoms of this condition will be summarized later.

3. CHOKED DISC is a common symptom of lesions of the base of the cerebrum, and of any intracranial disease which produces a gradually increasing pressure. It is specially diagnostic of tumors. It is not associated with impairment of vision until late, so that it is often unsuspected when present. The ophthalmoscope is necessary for its detection. It may coexist with hemianopsia, and is always bi-lateral. It is a positive contra-indication to trephining.

Lesions at the base of the skull may *cross the mesial line*, and still involve only one optic tract. If this occurs, the hemianopsia will be accompanied by other symptoms of diagnostic importance, no longer confined to one side. Double anosmia, general paresis or complete paralysis, general anæsthesia, and paralytic symptoms referable to both eyeballs might be thus produced. Lesions of this character are more liable to affect the chiasm of the optic nerves than the optic tracts; in either case, however, hemianopsia would result, and its type would be a reliable guide to the seat of pressure.

4. CROSSED PARALYSIS of the "facial nerve and body type" is not as

liable to coexist with hemianopsia as the two forms previously mentioned. The reason for this is a purely anatomical one.

5. UNCOMPLICATED HEMIANOPSIA indicates that the effects of the lesion are confined to the optic tracts of the chiasm, and that no pressure-effects are exerted upon the motor or sensory projection tracts, or adjacent nerves.

6. APHASIA sometimes coexists with hemianopsia. I have met with two instances of this kind. In one there was slight paresis of the left side, tending to prove that aphasia can occur with lesions involving the right hemisphere. Both were cured with specific treatment. We must attribute the development of this complication to pressure upon parts in the neighborhood of Broca's centre.

LESIONS AFFECTING THE MOTOR OCULI NERVE.

Lesions confined to the crus cerebri seldom create impairment of any of the special senses (excepting that of the sight in exceptional cases, by creating pressure upon one of the optic tracts). These cases are not associated with impairment of intellect or of speech. It has been claimed that severe lesions cause paralysis of the bladder, but I have never encountered it.

The third cranial nerve may be affected independently of, or in connection with, hemiplegia of the opposite side. The latter condition has been discussed already as a type of "crossed paralysis."

When the third cranial nerve is paralyzed from cerebral lesions, the *lower part of the face* is often paretic on the same side as the lesion; this is not the case when a lesion involves the nerve after it escapes from the crus cerebri, viz., within the middle fossa of the cranium or the orbital cavity.

CROSSED PARALYSIS of the "motor oculi nerve and body" type indicates a *lesion situated within the crus cerebri.* We find that the eye on the same side as the lesion can no longer be turned toward the nose or made to act in parallelism with the opposite eye; that the pupil is dilated; and that the upper eyelid droops over the eyeball, giving it a sleepy appearance. On the side opposite to the lesion the body is hemiplegic. There are few conditions which are of greater clinical importance than this type of crossed paralysis, because the seat of the lesion is positively indicated.

If the optic tract, which lies in close relation with the crus, be simultaneously affected by the lesion, the evidences of "crossed hemianopsia" will be superadded, viz., the eye on the same side as

the lesion will be blind in its temporal half, and that of the opposite side in its nasal half.

LESIONS AFFECTING THE FOURTH CRANIAL NERVE.

The nerves which are associated with the movements of the eyeball—the third, fourth, and sixth cranial—pass through the middle fossa of the cranium in company with the fifth cranial nerve. For this reason, lesions situated at the *base of the brain* are liable to involve any of these nerves separately or all simultaneously, according as their pressure-effects are felt in one direction or another.

In addition to cranial causes, lesions of the *orbit* may also create impairment of the third, fourth, ophthalmic branch of the fifth, or sixth cranial nerves—all of which pass through the sphenoidal fissure into the orbit.

Impairment of the sixth cranial nerve is indicated by the development of *internal strabismus;* the extent of which varies with the degree of the paralysis.

If this nerve be affected by lesions within the cranium, *other nerves are liable to be simultaneously involved;* and an impairment of the cerebral motor tract may also be evidenced by a coexisting *hemiplegia* or *paresis* of the side of the body opposite to the seat of the lesion.

LESIONS AFFECTING THE FIFTH CRANIAL NERVE.

The following propositions will cover the diagnostic points of lesions of the trigeminal nerve:

Peripheral lesions cause *anæsthesia of special parts* supplied by small branches or single filaments of the nerve.

The *coexistence of paralysis of other cranial nerves* with anæsthesia of the face, indicates a lesion in the vicinity of the base of the cerebrum.

If *a part of the face* and the *corresponding facial cavity* (orbital, nasal, or buccal) are simultaneously affected with a loss of sensation, the lesion is within the cranium, and so situated as to involve one of the three main divisions of the nerve.

If the anæsthesia extends over the *entire area supplied by all of the branches* of the nerve, and evidences of disturbance in the *nutrition of the parts* are also present, the lesion affects the ganglion of Gasser or its immediate neighborhood.

If the *muscles of mastication* are paralyzed, and no anæsthesia ex-

ists, the lesion is outside of the cranium and involves only the motor root of the inferior maxillary branch of the nerve.

The anterior two-thirds of the tongue, the mucous lining of the floor of the mouth, and the integument of the chin will be rendered anæsthetic simultaneously if the *sensory trunk* of the inferior maxillary nerve is involved; and taste may be affected also on the same side as the sensory paralysis.

Neuralgia of the various branches of the fifth nerve may exist in place of anæsthesia, provided the lesion simply *irritates* the nerve-trunks, but does not impair their power of conduction of sensory impulses.

LESIONS OF THE SEVENTH CRANIAL NERVE.

The following propositions will cover the diagnostic points of lesions which induce facial paralysis (Bell's palsy):

If the paralysis be limited to *distinct parts* of *one lateral half of the face*, the lesion affects only individual branches of the nerve, and is outside of the cranium. An apparent exception to this rule is sometimes met with in connection with lesions of the crus cerebri—paralysis of the lower half of one side of the face being clinically observed to occasionally accompany a paralysis of the motor oculi nerve on the same side as the lesion.

If the *fauces* and *palate* exhibit paralytic changes lesion is within the cranium or in the temporal bone.

If the *sense of taste* be lost in the anterior two-thirds of the lateral half of the tongue of the same side as the general facial paralysis, the lesion is either within the cranium, or in the temporal bone, above the origin of the chorda tympani branch.

If the *sense of hearing* is rendered *very acute upon the same side as the facial paralysis*, the lesion is probably within the temporal bone and involves the ganglionic enlargement found upon the nerve in the aqueduct of Fallopius.

Facial paralysis dependent upon *cerebral lesions* is commonly associated with *hemiplegia*, which may be upon the same side as the lesion or on the opposite side.

Crossed paralysis of the "facial nerve and body type" indicates a *lesion of the pons Varolii* posterior to the line which connects the trigeminus nerve with its fellow at their escape from the pons (Gubler).

If the lesion be situated in front of Gubler's line the facial paralysis and the hemiplegia will be on the *same side*.

LESIONS AFFECTING THE CRANIAL NERVES AND NERVE-TRACTS OF THE MEDULLA OBLONGATA.

The facial, auditory, glosso-pharyngeal, pneumogastric, spinal accessory, and hypoglossal nerves have their apparent origin from the medulla, and are more or less imperfectly understood in regard to their connection with different parts of the encephalon.

Labio-glosso-pharyngeal paralysis (Duchenne's disease or "bulbar paralysis") is associated with successive destruction of the *nerve nuclei* in the *floor of the fourth ventricle* and a secondary degeneration of the nerve-trunks connected with them. The nerve which exhibits the first evidences of paralysis will often afford clinical data from which some deductions respecting the original seat of the lesion may be drawn. The more common lesions of the medulla include arteritis, thrombosis, traumatism, softening, hemorrhage, sclerosis, and tumors.

The development of "bulbar paralysis" is associated, as a rule, with neuralgic pains, muscular spasms, anæsthesia, and disorders of special senses.

Compression of the medulla oblongata has been shown to cause the respiratory phenomena termed "Cheyne-Stokes respiration," and also albuminous and diabetic urine. In the former the frequency and character of respiration constantly changes in some regular order—gradually increasing to a certain maximum, and then gradually decreasing in frequency till they cease, when they begin again to increase in frequency and depth.

The *vaso-motor centres*, which are situated within the medulla, help to explain many other visceral phenomena which are observed when it is diseased. These are too numerous and complex in their nature to be discussed here.

The differential diagnosis of suddenly developed lesions of the medulla, which are not immediately fatal, must rest upon the coexistence of certain functional disturbances. Among these may be chiefly mentioned: 1. Epileptiform attacks, occurring at the onset or later; 2. Hemiplegia or paraplegia; 3. Loss of consciousness; 4. Hyperæsthesia or circumscribed anæsthesia; 5. Dysphagia, vomiting or hiccough, and Cheyne-Stokes respiration, from interference with the pneumogastric nerve; 6. Embarrassment of speech, from interference with the hypoglossal nerve; 7. Deflection of the velum palati and uvula, from interference with the facial nerve; 8. Hydruria, from interference with the centre of renal circulation; 9. Dis-

betes, probably from interference with the centre of the vaso-motor nerves of the liver; 10. Normal electro-muscular contractility in the paralyzed parts.

If the lesion be *very extensive* and of *sudden advent*, death may occur without the bulbar symptoms being well defined.

LESIONS OF THE CEREBRAL CORTEX.

If the gray matter of the convolutions (cerebral cortex) be diseased, or affected by the pressure exerted upon it by lesions of the bone or meninges, the symptoms which result will be modified by the convolutions whose functions are so impaired.

If the so-called "*motor area*" of the convolutions be involved, the paralysis of motion which ensues will be confined exclusively to those groups of muscles (on the side opposite to the lesion) that are controlled by the special motor centres within the limits of the convolutions affected. This type of paralysis is called "*monoplegia*" in contradistinction to hemiplegia.

The *type of monoplegia* is a guide to the seat and extent of the lesion which has induced it (see description of the motor centres of the cortex in the author's work upon the anatomy of the Nervous System).

Cortical paralysis may often be *transitory*, if the lesion be slight and superficial; or it may be *permanent*, if deep and impinging upon the medulla oblongata.

In cortical paralysis, a *rigidity of the paralyzed muscles* is frequently developed *early* in the disease.

Consciousness is not usually lost in consequence of suddenly developed lesions of the cortex, unless the deeper part of the brain be injured.

Pain over the seat of lesions of the cerebral cortex is often complained of spontaneously with the attack; again, it may sometimes be elicited or increased by percussion over the seat of the lesion.

If *convulsive attacks* precede or accompany an attack of monoplegia, the lesion is probably cortical and of a kind which is inducing irritation of the motor convolutions. In a large proportion of such cases (Jacksonian epilepsy) the lesion is dependent upon syphilis.

The convolutions of the *frontal lobes* are not associated with motion; excepting the ascending, and the bases of the first, second, and third, frontal convolutions. Outside of this area, lesions of the frontal lobe apparently produce no symptoms. If Broca's centre be destroyed, *aphasia* follows.

The convolutions of the *occipital lobes* are apparently associated with more marked *mental derangement* when diseased than the frontal or temporal. Irritative lesions of the occipital convolutions sometimes tend to produce *colored perception* of objects and other *ocular spectra*. The power of vision seems to be more or less affected by lesions of this lobe.

The convolutions of the temporal lobe are associated with the special senses of smell, hearing, sight, and touch. Some cases of aphasia have been apparently induced also by lesions of this lobe.

Our ability to localize lesions of the sensory regions of the brain is less positive than of the motor area.

LESIONS OF THE INTERNAL CAPSULE OF THE BRAIN.

The situation of this bundle of nerve-fibres renders it liable to become directly involved when hemorrhage, softening, or tumors of the *central portions* of the hemisphere exist; or, indirectly, when these conditions affect the *caudate nucleus*, the *lenticular nucleus*, or the *optic thalamus*.

The most frequent seat of *cerebral apoplexy* is the corpus striatum; because that ganglion is extremely friable and very vascular. The optic thalamus probably ranks next in the order of comparative frequency. The blood-vessels which enter these bodies * through the anterior and posterior perforated spaces at the base of the cerebrum seem to be frequently affected with atheromatous degeneration and miliary aneurisms, and are often ruptured when subjected to any unnatural strain. Nature has given to the carotid and the vertebral arteries a remarkable tortuosity before their entrance into the cavity of the cranium, in order, as it were, to diminish the liability to rupture of blood-vessels by decreasing the velocity of the flow when the heart's action is excessive; but even this mechanical safeguard is not always sufficient to protect the intracranial vessels from rupture when extensively diseased.

Again, the condition of *softening* may result from embolic obstruction to some branches of the carotid (usually of the left side), because the nutrition of the parts supplied by the occluded vessel is thus arrested either entirely or in part. The same result may also follow an attack of cerebritis or a previous extravasation of

* The motor regions of the cortex are supplied by the *middle cerebral* artery; the nucleus caudatus by branches of the *anterior cerebral* and *anterior communicating* arteries; the lenticular nucleus by the *middle cerebral;* and the optic thalamus by branches of the *middle* and *posterior cerebral* vessels.

blood into the substance of the brain, both of which tend often to create impairment of the blood-supply to adjacent regions.

Finally, *tumors* sometimes develop within the cerebral hemispheres, and create pressure upon, as well as destruction of important nerve-tracts. Time will not permit us to enter into detail respecting all the diagnostic points by which the existence of each of these conditions may be recognized during life. I direct attention, therefore, only to such points as are of importance in the diagnosis of disturbance of the supposed functions of the internal capsule.

It may be stated with some degree of positiveness that, if the anterior two-thirds of the internal capsule be affected, a *hemiplegia* of the opposite side is developed.* This is more or less complete, according to the seat and extent of the lesion which causes it. The exciting cause may possibly be situated within the anterior or middle portions of the white centre of the cerebral hemisphere, above the level of the basal ganglia, in which case it interferes with the normal action of certain bundles of the internal capsule which spring from the motor convolutions of the cortex previously enumerated. Again, it may be situated within the constricted portion of the capsule, in which case bundles of nerve-fibres that are functionally associated with widely diffused areas of the cortex may be affected by a lesion of small size. Finally, it may be apparently confined to the substance of one of the two nuclei of the corpus striatum, or the optic thalamus, and still exert sufficient pressure upon the constricted part of the internal capsule to produce more or less extensive and complete paralysis of the opposite lateral half of the body.

The hemiplegia of intracerebral lesions forms, as a rule, a striking contrast with the various types of *monoplegia*, which are produced by circumscribed lesions of the cortex. The latter are often of the greatest aid to the neurologist in localizing the seat of the exciting cause.

The second symptom which may indicate a lesion of the internal capsule is *hemianæsthesia*. By this I mean a loss of sensation, more or less complete, which is confined to the lateral half of the body. It exists on the side opposite to the seat of the lesion. This may occur when fibres of the *posterior third* of the internal capsule are

* Exceptions to this rule are occasionally observed. The hemiplegia, in rare cases, exists on the same side as the lesion. The explanation of this fact has been shown, by the researches of Flechsig, to lie in the varying proportions of the direct and decussating fibres which pass from the cerebrum to the spinal cord.

destroyed or impaired by diseased conditions directly affecting them, as noted by Charcot, Raymond, Rendu, Ferrier, and others, or by the pressure exerted by lesions situated in parts adjacent to them. It is usually accompanied with a slight form of motor paralysis; probably because a few of the motor fibres of the internal capsule are, as a rule, simultaneously interfered with.

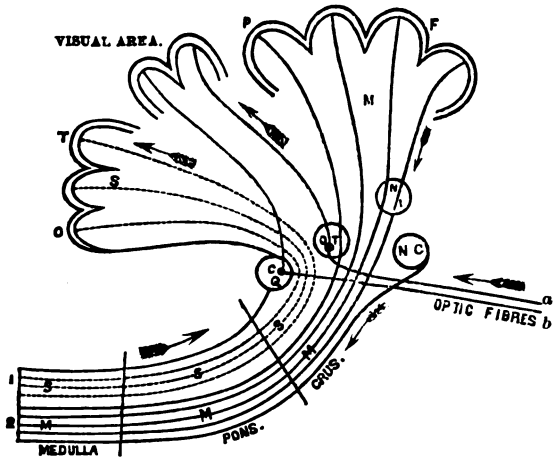
A third symptom of lesions of the internal capsule includes a variety of manifestations of *impairment of the special senses*. In connection with the discussion of the optic thalamus, views will be advanced later respecting the possibility of existence of special centres of smell, sight, hearing and sensation within the substance of that ganglion. Some clinical facts point strongly to a relationship between nerve-fibres connected with certain special-sense perceptions and the internal capsule. It is impossible, with our present knowledge, to definitely place the situation of the cortical centres which preside over the various special senses, or the course of separate fibres which seem to be associated with them, but we are forced to admit that some of the fibres of the posterior part of the internal capsule have a direct or an indirect association with smell, sight, hearing, sensation, and perhaps of taste also.

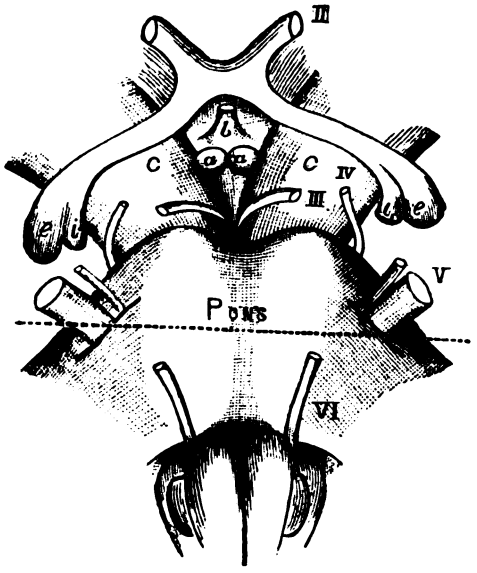
One peculiar fact cannot be omitted, however, which Charcot has endeavored to explain, viz., that hemianopsia (page 482) never occurs in connection with lesions of the internal capsule, but an amblyopia is developed on the same side as the cutaneous anæsthesia, with a remarkable contraction of the field of vision and difficulty in discrimination of color. The explanation which this author makes of this fact is, that a second decussation of the fibres of the optic nerve takes place somewhere between the optic chiasm and the internal capsule, probably in the tubercula quadrigemina.

When the radiating fibres of the internal capsule are involved in a lesion which creates a gradually increasing pressure (as in the case of tumors which grow slowly) the *fundus of the eye* exhibits morbid changes in the region of entrance of the optic nerve which are of value in diagnosis. The condition so produced is commonly known as the "*choked disc*."

In exceptional cases of destruction of the internal capsule, the *sense of smell* has been found to be abolished on the side opposite to the seat of the lesion. This fact requires special consideration, as it has been shown that the centre proper for olfactory perceptions seems to be in the hemisphere of the same side. Meynert claims, however, to have demonstrated the existence of an olfactory chiasm in the region of the anterior commissure (in animals where the

PLATE XXV.





Medulla

A DIAGRAM DESIGNED TO SHOW THE GENERAL COURSE OF FIBRES IN THE "SENSORY" AND "MOTOR TRACTS," AND THEIR RELATION TO CERTAIN FASCICULI OF THE OPTIC NERVE-TRACTS. S, sensory tract in posterior region of mesocephalon, extending to O and T, occipital and temporal lobes of hemispheres; M, motor tract in basis cruris, extending to P and F, parietal and (part of) frontal lobes of hemispheres; O Q, corpus quadrigeminum; O T, optic thalamus; N L, nucleus lenticularis; N C, nucleus caudatus. 1. The fibres forming the "tegmentum cruris" (Meynert). 2. The fibres forming the "basis cruris" (Meynert); *a*, fibres of the optic nerve which become associated with the "optic centre" in the optic thalamus, and are subsequently prolonged to the "visual area" of the convolutions of the cerebrum; *b*, optic fibres which join the cells of the "corpora quadrigemina," and are then prolonged to the visual area of the cerebral cortex."

A DIAGRAM OF THE BASE OF THE BRAIN, DESIGNED TO SHOW THE PARTS ADJACENT TO THE OPTIC NERVE-TRACTS AND CHIASM. The nerves are represented by their repective numbers; II., optic; III., motor oculi; IV., trochlearis; V., trigeminus; VI., abducens; C, crus cerebri of each hemisphere; *b*, infundibulum, the pituitary body being cut off to show the optic chiasm; *a*, the corpus albicans (mamillary tubercle); *e*, external geniculate body; *i*, internal geniculate body. The dotted line which crosses the pons Varolii, connecting the roots of the fifth nerves, is Gubler's line, an important guide, since lesions of the *pons* in front of it cause "crossed facial paralysis." Lesions in the region of the *crus* may involve the third and second nerves simultaneously. Lesions about the chiasm may press upon the corpus striatum within the mass of the cerebrum. The crus comprises both the motor and sensory tracts of the cerebrum.

bulbs are largely developed); and fibres have been traced in the region of the "subiculum cornu Ammonis," or the tip of the temporo-sphenoidal lobe, which connect the olfactory centres with each other. The experiments of Ferrier tend to disprove the decussation of the olfactory paths in the anterior commissure; so that the question still remains unsettled. The sense of smell is more commonly affected in the nostril of the side which corresponds to the seat of the lesion.*

Among the fibres of the internal capsule which are distributed to the temporo-sphenoidal lobe some appear to have some association with the *sense of hearing;* but experimentation upon animals to determine the exact seat of the centres of hearing and the effects of their destruction are exceedingly difficult, because the evidences of impairment of this sense are more or less vague. Ferrier thinks, however, that the *superior temporal convolution* is unquestionably connected with acoustic perceptions. The area which he maps out as acoustic in function is quite extensive.

The *region of the hippocampus* seems to be chiefly connected with *tactile sensibility,* because its destruction has been found to create a total loss of that sense on the opposite side of the body (Ferrier).

As regards *taste,* the results of experimentation upon the monkey tribe seem to point to the *lower portion of the middle temporal convolution* as the probable seat of the centres which are related to that sense.† When this region is subjected to irritation, certain reflex movements of the lips, cheek, and tongue are observed, which seem to point to an excitation of the gustatory sense. Its destruction causes abolition of taste.

We have now considered three of the more prominent symptoms which are produced by lesions of the internal capsule, and I pass to a fourth, which I believe to be of great value in aiding the recognition during life of an extensive and rapidly developing lesion of the white centre of the cerebral hemisphere, viz., *conjugate deviation of the eyes and head.* This has been already discussed on page 480.

A fifth symptom, which points strongly to an existing lesion of the internal capsule, is *choreiform movements* following hemiplegia or hemianæsthesia. These movements vary in type and degree. In some cases, the movements exhibit the peculiarities of athetosis, the

* Ferrier reports a case where smell and taste were simultaneously abolished by a blow upon the top of the head. Ogle records a similar instance.

† This may help to explain the fact that injuries received upon the vertex and occipital protuberance cause, in some instances, an abolition of taste. The temporal lobe being injured by concussion against the adjacent bone.

fingers or toes being thrown into active motions which cannot be controlled by the patient; in others, true ataxia may be developed; again, the spasmodic movements partake of the character of genuine chorea; finally, a tremor, more or less marked, may be detected.

It is not uncommon to find that both hemiplegia and hemianæsthesia may co-exist with these post-paralytic forms of spasmodic disease; but one usually overshadows the other, the hemiplegia being, as a rule, the more marked. How we are to explain these late phenomena, is not definitely settled. They are probably to be classed with other morbid manifestations which paralyzed muscles sometimes exhibit, chiefly that of "late rigidity" so often seen, concerning the cause of which many conjectures have been advanced, but nothing of a positive nature demonstrated.

Finally, it has been observed that lesions of the internal capsule, if very extensive, are often followed by a very marked *rise in the temperature* of the body. We have yet much to learn concerning the vaso-motor centres which are variously disposed within the substance of the brain and spinal cord.

The fact has been mentioned that most of the fibres of the internal capsule probably terminate, anteriorly, in the *motor convolutions* of the cerebral cortex. Although there are still some neurologists of note who deny the value of the late attempts of Fritsch, Hitzig, Broca, Ferrier, Charcot, Hughlings-Jackson, Pitres, Landouzy, Exner, Chouppe, and a host of others, to locate special centres within the convolutions of the cortex, clinical and pathological observations are constantly being brought forward in support of the more generally accepted views. The region which embraces these motor centres appears, however, to be somewhat limited. A critical review of the recorded cases shows, I think, beyond cavil, that the white centre of each hemisphere of the cerebrum, as well as the cortex, may, in some instances, be extensively diseased or injured without any motor or sensory results which can be determined. Pathological evidence seems to demonstrate, however, that the region so impaired must not be situated where the fibres of the internal capsule suffer destruction or pressure if we expect to meet with negative results. Abscesses of immense size have been found in the anterior part of the frontal lobe, as well as in certain portions of the occipital and temporo-sphenoidal lobes, without any sensory or motor paralysis during life to indicate the existence of such a lesion. Tumors, softenings, and the most severe types of traumatism have likewise occurred without creating serious effects.

In case of the occipital and temporo-sphenoidal lobes, to which

some of the posterior fibres of the internal capsule are probably distributed, sensory and psychical symptoms have been observed by some to follow circumscribed lesions. A more careful consideration of such cases will perhaps demonstrate the functions of these convolutions more clearly; but at present they are somewhat conjectural. Some forcible arguments have been advanced of late to prove a relationship between the occipital lobes and the mental faculties in opposition to the more commonly accepted doctrine that the frontal lobes were those of intelligence. The temporal lobes seem to exert an influence upon the special senses of touch, smell, and hearing. The angular gyrus of the parietal lobe is probably associated in some way with vision. An apparent connection of the optic and auditory functions with the cerebellum and optic thalamus exists. The bearing of morbid phenomena of the special sense of sight upon diagnosis has been considered in previous pages.

In closing this important subject, let me suggest, that it is by no means certain that lesions, which primarily affect the constricted portion of the internal capsule, may not, in themselves, create sufficient pressure upon the corpus striatum and the optic thalamus to cause interference with the free action of some of the *special centres* which are believed to exist within those bodies. If this be the case, many of the interesting phenomena which will be described during our discussion of lesions of the optic thalamus, would *coexist* with those symptoms of disease within the internal capsule already mentioned. Ritti's views respecting the relations of the optic thalamus to hallucinations, and those of Luys pertaining to its olfactory, optic, and acoustic functions have a special interest in this connection.

LESIONS OF THE OPTIC THALAMUS.

Efforts have been made by some of the later anatomists, who have specially investigated the brain, to subdivide the gray matter of the thalamus into circumscribed masses or nuclei, and to trace the fibres which appear to arise from these nuclei to special regions of the brain and spinal cord. Among the most attractive of these attempts may be mentioned that of Luys, whose views will be subsequently given in detail. Whether clinical research and physiological experiment will confirm all of these attractive theories, and place them upon a ground as worthy of credence as the deductions of Broca and Ferrier regarding the functional attributes of other parts of the brain, time alone can decide.

According to the researches of Luys, four isolated ganglions may

be demonstrated in the thalamus. Arnold, in common with some other anatomists, has recognized three of these, and the fourth is now added by the author quoted. This author states that these ganglia are arranged in an antero-posterior plane, and form successive tuberosities upon the thalamus, giving that body the appearance of a conglomerate gland.

The anterior ganglia (*corpus album subrotundum*) is especially prominent. It appears to be developed in animals in proportion to the acuteness of the sense of smell. By means of the "tenia semicircularis," this ganglion (according to Luys) may be shown, in the human species, to be connected with the roots of the olfactory nerve. Respecting it he says: "Direct anatomical examination shows that there are intimate connections between the anterior centre and the peripheral olfactory apparatus. On the other hand, in confirmation of this, in the animal species, in which the olfactory apparatus is very much developed, this ganglion itself is proportionally very well marked. Analogy has thus led us to conclude that this ganglion is in direct connection with the olfactory impressions, and that this marks it as the point of concentration toward which they converge before being radiated toward the cortical periphery."

The *second or middle centre* is in apparent continuity with the fibres of the optic tract. It may therefore be considered, on the same grounds as those previously quoted respecting the anterior centre, as a seat of condensation and radiation of visual impressions.* There seem to be indisputable grounds for the belief that the geniculate bodies, the corpora quadrigemina, and the angular gyrus of the parietal lobe are, in some way, also associated with the perceptions afforded by the retina. Possibly, moreover, the occipital lobes may be added to the ones previously mentioned, since physiological experiment tends toward that view. Ritti has pointed out that irritation of the thalamus may play an important part in the development of hallucinations. We know that extirpation of the eye is followed by more or less complete atrophy of the outer geniculate body of the opposite side, although the inner geniculate body seems to remain unaffected. The experiments of Longet, who destroyed the optic thalami upon both sides without being able to note any impairment of vision or influence upon the movements of the pupil; and those of Lussana and Lemoigne, who found that blindness of the opposite eye followed unilateral destruc-

* Luys states that it is scarcely visible in those animals (the mole as an example) where the optic nerves are rudimentary.

tion of the thalamus, may suggest the possibility, in the former, of the escape of this centre and, in the latter, its destruction. . It is difficult to devise any experiment which will positively settle the bearings of the thalamus upon vision; because it is almost impossible to destroy special portions with accuracy, or if this were insured, to avoid injury to adjacent structures. Fournié claims to have effected the separate annihilation of the special senses of smell and vision by injections made into different parts of the thalamus of animals; and his experiments, if subsequently verified, will tend to confirm some of the theories advanced by Luys.

The *third centre* ("median ganglion" of Luys) is described as about the size of a pea, and situated mathematically in the exact centre of the thalamus. To it the discoverer ascribes the function of presiding over and condensing all *sensory impressions.*

The *fourth posterior centre* is stated to act as a halting place and condenser of *auditory impressions.* Two instances where the brains of deaf-mutes were found to present a localized lesion of this centre are reported by Luys.

The views here expressed are quoted on account of their originality; and the author of them ranks high as an authority upon the subject of which he speaks. The numerous cases of cerebral hemorrhage which have been reported, where the thalamus was apparently the seat of localized injury, are too often accompanied with a clinical history which points toward pressure upon the internal capsule to be of value as confirmatory evidence of the existence of special centres in the thalamus. The effort of Luys to adduce cases of hemianæsthesia in support of his views regarding the function of the "median centre" of the thalamus, merely because a lesion of that ganglion was found in an area defined by him as the normal limits of that special centre, must not be deemed conclusive; because the same effect *might* have been produced by pressure upon the *posterior third* of the internal capsule of the cerebrum. There is every reason to hope and possibly to believe that sooner or later isolated ganglia within the optic thalamus will be demonstrated to exist by normal and pathological anatomy as well as by physiological experiment; but the conclusions even of so prominent an author should not be fully accepted without further testimony to substantiate their accuracy.

Some interesting cases have, however, already been brought forward, which certainly seem to sustain the views advanced. A case reported by Hunter,* where a young woman successively lost the

* Medico-chirg. Trans., London, 1825, vol. xiii.

senses of smell, sight, sensation, and hearing, and who gradually sank, remaining a stranger to all external impressions, disclosed at the autopsy a fungus hæmatodes which had gradually destroyed the optic thalamus of each side, and the optic thalami only, if the drawing given is reliable. Again, Fournié's experiments on living animals points strongly to the existence of localized centres in the thalamus. Three instances of unilateral destruction of smell, observed by Voisin and reported by Luys, have been found to be associated with a destruction of the anterior centre of the thalamus. A hemorrhagic effusion into the thalamus, on a level with the soft commissure (the situation of the optic centre of Luys), produced (in the experience of Serres) a sudden loss of sight in both eyes. Ritti's paper upon the effects of irritation of the thalamus upon the development of hallucinations, lends strength to the view that that ganglion in some way regulates the transmission of sensory impressions of all kinds to the cerebral cortex; and confirms the opinion that "the optic thalami are to be regarded as intermediary regions which are interposed between the purely reflex phenomena of the spinal cord and the activities of psychical life."

The view taken by Lussana and Lemoigne, that the optic thalami contained motor centres in animals for the lateral movements of the forelimbs of the opposite side, seems to be completely overthrown by pathological statistics in the human race. The results obtained by these experimenters are also at variance with the belief, which has now become general among neurologists, that the thalami are intimately connected with the sensory tracts of the cerebrum and cord; since they concluded that no evidence of pain or any loss of sensibility resulted from injury to these bodies.

The effects of all experiments on animals, however, agree entirely with the general experience of pathologists, that lesions of both the thalamus and corpus striatum produce results upon the opposite side of the body; whether the symptoms produced point to a disturbance of the kinesodic (motor) or æsthesodic (sensory) tracts. The view originally advanced by Carpenter and Todd, that the thalami are concerned in the upward transmission and elaboration of sensory impulses, in contradistinction to the corpora striata which are concerned in the downward transmission and elaboration of motor impulses, seems to be gaining ground, and many facts may be urged in its favor.

When the cerebrum is removed from some animals, the frog in particular, the basal ganglia being left intact, and some outward excitation be afterward used to induce movement in the animal so

mutilated, there is every indication *that the animal can see*, because it avoids objects placed before the eyes, in case they tend to obstruct its passage.* Its movements are those of an entire frog, except that they require some external stimulus to call them forth. It can be made to crawl, jump, croak, swim, and perform all other acts of an automatic machine. It is the effect of light upon its movements, however, that has some bearing upon the existence of a *visual centre* within the substance of the thalamus, since no observer has ever demonstrated that the corpus striatum is related either anatomically or physiologically with that sense.

LESIONS OF THE CORPUS STRIATUM.

The *lenticular nucleus* of this ganglion is probably connected with the motor fibres of the "internal capsule of the cerebrum." There is more doubt in reference to the functions of the *caudate* nucleus.

The results of lesions of either nucleus are attributed by most authors to pressure-effects upon the anterior or motor fibres of the internal capsule. In no instance, to my knowledge, has the destruction of these nuclei produced psychic manifestations.

The *hemiplegia*, which follows injury to the corpus striatum, is absolutely confined to the side opposite to the lesion; in cases of extreme rarity, paralysis of motion on the same side has been clinically recorded; but Flechsig has proved that such cases are to be interpreted as the result of an individual peculiarity in the relative number of decussating and direct pyramidal fibres.

These and other facts pertaining to the so-called "motor tract" of the cerebrum have been touched upon (page 476).

The corpus striatum, like the optic thalamus, may be considered, therefore, as a territory in which cerebral, cerebellar, and spinal activities are brought into intimate communication. It acts as a halting place for voluntary motor impulses emitted from the cerebral cortex. It enables these impulses to become modified and possibly reinforced by currents derived from the cerebellum; and, by its efferent fibres, it transmits centrifugal motor impulses along the projection system to different groups of cells within the spinal gray matter, whose individual functions they tend to evoke.

This ganglion probably acts as a condenser and modifier of all motor acts which are the result of volition; and 'manifests, through

* Such an animal will even try to avoid *strong shadows* thrown by the sunlight across its path.

the agency of its satellites (the cells of the anterior horns of the gray matter of the spinal cord), the outward expressions of our personality.' Without the influence of the cerebral hemispheres, it is also capable, by means of cerebellar innervation, of governing all the complex muscular movements required in maintaining equilibrium (coördinated movements). Finally, it may be presumed to possess the power of analysis of cerebral and cerebellar currents received simultaneously, and of materializing them by the intervention of its nerve-cells, projecting them in a new form, amplified and incorporated with the requirements of the general organism.

Experiments made upon the caudate and lenticular nuclei can hardly be said to have afforded results which can be made the basis for positive deductions respecting the functions of each. Nothnagel employed injections of chromic acid into the substance of each, and also destroyed them by means of an instrument devised for that purpose, but he made no positive conclusions save that the lenticular nucleus seemed to have a more decided influence upon motion than the caudate nucleus, when both sides were simultaneously destroyed.

Some observers claim to have removed the entire ganglion without any marked disturbance of sensory or motor phenomena.

RULES GOVERNING THE USE OF THE TREPHINE.

If *anæsthesia* coexists with *motor paralysis*, following an injury over the *motor area* of the brain, trephining is contra-indicated. The lesion is either too extensive to be relieved, or the brain is torn or compressed at a point removed from the seat of apparent injury (probably the "internal capsule," in its posterior third, is involved).

For the same reason, *convulsive movements* or *motor paralysis*, if following an injury over the *sensory regions* of the cortex, are not fit cases for surgical interference.

Paralysis of motion on the same side as that upon which the cranial injury has occurred should always deter the surgeon from trephining, because the opposite side of the brain has probably been injured by transmitted force (*Contre-coup*).

Profound motor paralysis indicates, as a rule, a lesion which affects deeper parts than the cerebral cortex, and the chances for surgical relief are extremely doubtful.

Paralysis of any of the cranial nerves in connection with body paralysis should be regarded as a contra-indication to the use of the trephine.

Cheyne-Stokes respiration, vomiting, and *choked disc,* indicate lesions at the base of the brain which cannot be reached by any surgical interference.

Aphasia, when following immediately after an injury, is probably due to depressed bone or a blood-clot over Broca's centre; if it occurs within a few weeks after an injury, an abscess of that region probably has developed. Both of these causes might be relieved by surgical aid, the trephine being employed directly over the base of the third frontal convolution (see guides given by the author in his "Treatise upon the applied anatomy of the nervous system").

Monoplegia in any of its varieties, when dependent upon traumatism and not accompanied by anæsthesia, affords the surgeon a reliable guide to the seat of the lesion, and a reasonable hope of success in removing the cause by trephining.

PARALYSIS FROM CORTICAL CEREBRAL LESIONS.	PARALYSIS FROM NON-CORTICAL CEREBRAL LESIONS.
CONSCIOUSNESS.	
Is seldom lost at the onset of paralysis, unless the lesion be extensive or due to traumatism. If ushered in with an epileptic attack, consciouness is of course lost.	A sudden loss of consciousness usually accompanies the development of the lesion or its manifestation in the form of paralysis. Convulsions are not usually present during the "paralytic attack."
PAIN.	
Local pain within the head is often complained of at the time of the attack.	The patient is usually unconscious at the time of the attack and for some time after; and (even after the attack) pain in the head is a less constant symptom.
PERCUSSION.	
Percussion over the seat of the lesion often elicits pain.	Negative in its results.
PARALYSIS.	
Monoplegia (in any of its forms) is typical of this condition. *Special groups* of muscles are paralyzed, and some more than others. The paralysis is often transitory, if the lesion be slight or superficial. The group of muscles, which is the last to show improvement, may be a valuable guide in localizing the seat of injury. Sensibility is usually unimpaired.	*Hemiplegia* or *hemianæsthesia*, more or less profound, follow the development of the lesion, as a rule. Both may coexist in some cases. It is slow in recovery. The improvement is comparatively uniform, so far as special groups of muscles are concerned. More or less anæsthesia usually coexists with the motor paralysis.

PARALYSIS FROM CORTICAL CEREBRAL LESIONS (*continued*).	PARALYSIS FROM NON-CORTICAL CEREBRAL LESIONS (*continued*).
MUSCULAR RIGIDITY.	
The paralyzed muscles often exhibit rigidity at an *early* date.	Early rigidity of the paralyzed muscles is rare in central cerebral disease.
CHOREIFORM MOVEMENTS.	
Infrequent as a sequel to the paralysis.	Frequently follow the development of the hemiplegia or hemianæsthesia.
ELECTRO-CONTRACTILITY.	
The paralyzed muscles exhibit normal electro-contractility.	Usually impaired or modified.

SYMPTOMS IN COMMON.

Both are associated with motor paralysis.
" may be associated with post-paralytic rigidity of muscles.
" " " " sudden advent.
" " " " traumatism.
" " " " convulsions.

IRRITATIVE LESIONS OF THE CEREBRAL CORTEX. (JACKSONIAN EPILEPSY.)	DESTRUCTIVE LESIONS OF THE CEREBRAL CORTEX.
HISTORY.	
Syphilis is by far the most frequent cause of this condition.	Syphilis is only one of many causes of this condition, and by no means the most common (see page 477).
CONVULSIONS.	
The patient is seized with convulsive attacks of the epileptic type, which are followed by *transient* paralysis. The part which *first shows rigidity* during the convulsion points toward the motor centre for that part as the seat of greatest irritation. It may thus assist in localizing the seat of the lesion.	Convulsions are usually absent.
PARALYSIS.	
The paralysis is somewhat of the "*monoplegic*" type, but is usually transitory. It is not so well defined as in the case of destructive lesions. It exists on the side opposite to the lesion.	A well-marked "monoplegia" is developed, which is more or less permanent according to the character of the lesion. It affects the side opposite to the lesion. The groups of muscles affected with paralysis will aid in deciding as to the seat and extent of the lesion.
PROGNOSIS.	
Good—on account of its syphilitic origin.	Depends entirely upon the character of the lesion, its seat, and extent.

CROSSED PARALYSIS.

OLFACTORY NERVE AND BODY TYPE.	TRIGEMINUS NERVE AND BODY TYPE.
SENSATION IN FACE.	
Normal.	Impaired or lost as far as the median line. Conjunctiva, nostril, lips, gums, and tongue participate in the anæsthesia, as far as one lateral half of the head is concerned. Neuralgia may coexist with anæsthesia, if it is not complete.
SPECIAL SENSES.	
Anosmia (loss of smell) will exist in the nostril opposed to the hemiplegic side of body.	Smell may be impaired from an effect of the sensory paralysis upon the *mucous secretion* of the nostril affected. Taste may be impaired or lost in one lateral half of the tongue for its anterior two-thirds.
CHIN.	
Normal.	May be deflected away from the hemiplegic side of body, if the motor branches of the nerve are paralyzed.
MASTICATION.	
Normal.	Impaired, on account of paralysis of the temporal, masseter, and pterygoid muscles of the side rendered anæsthetic, if the motor root of the nerve is affected.
BODY PARALYSIS.	
Hemiplegia exists on the side of the body opposed to the nostril, in which the sense of smell has been destroyed.	Hemiplegia exists on the side opposed to the symptoms described above; hence on the side opposite to the exciting lesion.

CROSSED PARALYSIS OF THE OLFACTORY NERVE AND BODY TYPE (*continued*).	CROSSED PARALYSIS OF THE TRIGEMINUS NERVE AND BODY TYPE (*continued*).
SITUATION OF LESION.	
Probably in the *anterior fossa* of the cranium. Sufficiently large in extent to simultaneously affect the olfactory nerve and the "motor tract" or the corpus striatum.	Probably in the *middle fossa* of the cranium or in the region of the pons Varolii. If in the latter, it may induce paralysis of the seventh nerve simultaneously.

SYMPTOMS IN COMMON.

Both are associated with hemiplegia.

" may be associated with impairment of the sense of smell.

CROSSED PARALYSIS.

MOTOR OCULI NERVE AND BODY TYPE.

Face.

Pupil dilated on same side as the lesion.

External squint on same side as the lesion.

Ptosis on same side as the lesion.

Eye prominent on same side as the lesion.

Mouth.

The lower portion of face is occasionally paralyzed on the side corresponding to the hemiplegia—hence on the side opposite to the lesion.

Special Senses.

Not affected. The patient may see objects as if doubled (in certain attitudes of the head). Double images are obviated, however, by altering the position of the head so as to allow both eyes to focus upon the object.

FACIAL NERVE AND BODY TYPE.

Face.

Eye cannot be closed on same side as the lesion.

Obliteration of facial wrinkles on same side as the lesion.

Nostril collapsed on same side as the lesion.

Mouth.

Mouth is drawn toward hemiplegic side.

Tongue cannot be protruded in a straight line.

Lips cannot be symmetrically puckered (as in act of whistling).

Taste is sometimes impaired.

Arch of palate is rendered straight on the paralyzed side.

Uvula is deflected toward the hemiplegic side.

Food accumulates in the cheek from paralysis of the buccinator.

Saliva dribbles constantly.

Special Senses.

Hearing may be rendered excessively acute (tensor tympani muscle affected).

Taste may be affected (chorda tympani nerve paralyzed).

Smell is not impaired, if the nostril is held open.

CROSSED PARALYSIS OF THE MOTOR OCULI NERVE AND BODY TYPE (*continued*).	CROSSED PARALYSIS OF THE FACIAL NERVE AND BODY TYPE (*continued*).
BODY PARALYSIS.	
Hemiplegia exists on the side of the body opposed to the eye deformity; hence on the side opposite to the lesion.	Hemiplegia exists on the side of the body opposed to the facial deformity; hence on the side opposite to the lesion.
SITUATION OF LESION.	
Within the *crus cerebri* of the hemisphere opposite to the side rendered hemiplegic.	In the *pons Varolii*, on the side opposite to the hemiplegia, and posterior to a line connecting the roots of the Trigemini (Gubler).

SYMPTOMS IN COMMON.

Both are associated with eye deformity.
" " " " hemiplegia.
" may be " " paralysis of the lower portion of the face.

BILATERAL FACIAL PARALYSIS. (FACIAL DIPLEGIA.)	UNILATERAL FACIAL PARALYSIS. (BELL'S PALSY.)
MOUTH.	
The mouth cannot be closed.	The mouth is drawn toward unaffected side.
CHEEKS.	
Both cheeks are flaccid.	The cheek is flaccid on the affected side.
MASTICATION.	
Mastication is impossible, if the diplegia be complete.	Mastication is difficult if the motor branches of the nerve are paralyzed; but it is still slowly performed.
DEGLUTITION.	
Deglutition is impossible, without the aid of the finger.	Deglutition is normally performed.
THE EXPRESSION.	
The features are fixed and immobile. The alæ nasi and cheeks collapse with each inspiration and are puffed out with each expiration.	One *lateral half* of the face is immobile. The opposite half is distorted. One nostril is collapsed.
VOICE.	
The voice is nasal.	No vocal changes are developed.
SPEECH.	
Speech becomes almost unintelligible.	Speech is not markedly altered.
ACT OF EATING.	
The food is pushed into the pharynx by the fingers.	The finger is employed to empty the food from the cheek of paralyzed side.

BILATERAL FACIAL PARALYSIS (*continued*).	UNILATERAL FACIAL PARALYSIS (*continued*).
UVULA.	
Is flaccid and paralyzed, but still symmetrical.	The arch of the palate is unsymmetrical; one side being curved and the other straight.
HEARING.	
May be rendered excessively acute in both ears.	May be rendered more acute in the ear of the paralyzed side than on the opposite.
CAUSES.	
Basilar tumors. Exostoses of the basilar process. Aneurisms. Meningeal exudations inducing atrophy of the facial nerves. Necrosis, caries, or suppurative diseases of both temporal bones.	Cranial or cerebral lesions affecting one facial nerve. Lesions of temporal bone of paralyzed side. Traumatism. Surgical operations. Severe cold. Rheumatism. Diphtheria. Syphilis.

SYMPTOMS IN COMMON.

Both are associated with facial deformity.
" " " " immobility of the features.
" " " " difficulty in eating.
" " " " escape of the saliva from the mouth.

MOTOR PARALYSIS OF CEREBRAL ORIGIN.	TABES DORSALIS. (LOCOMOTOR ATAXIA.)
SENSORY PHENOMENA.	
Anæsthesia is absent, unless the posterior third of the "internal capsule" is affected by the lesion.	*Anæsthesia* and *delayed sensation* exist.
Pain is usually absent in the limbs.	*Pain* (which is paroxysmal and very intense) exists, long before difficulty in *coördination of movement* appears. It is usually of a *boring or stabbing* character and is circumscribed within distinct regions which change with each paroxysm.
Hyperæsthesia is not a characteristic symptom.	*Hyperæsthesia* exists at the *seat of pain*, after the paroxysm has passed away.
Consciousness *may* be lost at the time of the attack.	Consciousness is seldom if ever lost.
MOTOR PHENOMENA.	
The affected muscles are found to be markedly deficient in *power*, when subjected to tests which are calculated to determine it.	The muscles of the limbs are not found to be lacking in power when *tested separately*. They cannot, however, be made to perform coördinated movements as in health.
The paralysis is usually unilateral.	The symptoms are commonly bilateral.
Coördinated movements are performed perfectly but feebly if the motor paralysis is not complete.	Voluntary movements are more or less hindered by the inability to coördinate the muscles.
REFLEX TESTS.	
The *spinal reflexes* are normal; even if the motor paralysis is quite profound.	The reflexes are either impaired or lost. The so-called reflex tests are of value often in determining the extent of the lesion.

MOTOR PARALYSIS OF CEREBRAL ORIGIN (*continued*).	TABES DORSALIS (LOCOMOTOR ATAXIA) (*continued*).
PUPILS.	
The pupils may be irregular or normal.	The so-called "Robertson pupils" are observed (when the disease affects the cervical region of the cord).
They respond to light and to the accommodation of vision for near objects.	They are preternaturally *small* and respond to attempts at accommodation of vision but not to light.
They are affected by atropine as in health.	Atropine often fails to dilate them as in health.
CRANIAL NERVES.	
Amaurosis occurs often if the "internal capsule" of the brain be injured; but it may be absent, if the lesion be elsewhere.	*Amaurosis* is often developed, when the disease has extended to the brain.
Lesions confined to the "internal capsule" of the brain may affect the color perceptions.	The *sense of color* perception may be partially abolished (red and green being affected first—yellow and blue last).
Conjugate deviation of the eyes is a common symptom of lesions of the internal capsule. The head is usually rotated toward the side upon which the lesion is situated.	The *motor oculi nerve* is sometimes paralyzed, causing diplopia, ptosis, and external strabismus—although the *pupil remains small.*
Crossed paralysis of various types may be developed.	*Trigeminal anæsthesia* often occurs, but the muscles of mastication are not usually affected. Taste may be impaired.
Bulbar paralysis is an infrequent complication of suddenly developed lesions.	The symptoms of *Duchenne's disease* are induced in some instances.
ELECTRICAL PHENOMENA.	
At the onset, galvanic excitability of the nerves is usually increased.	Galvanic excitability is abnormally increased in the irritative forms of ataxia.
In cases of long standing or where the paralysis is complete, Faradomuscular contractility is usually decreased as the result of atrophic or degenerative changes in the muscles.	Farado-muscular contractility may be increased at first, but is markedly decreased in the later stages of the chronic type of the disease.

MOTOR PARALYSIS OF CEREBRAL ORIGIN (*continued*).	TABES DORSALIS (LOCOMOTOR ATAXIA) (*continued*).
DEVELOPMENT.	
The paralysis usually occurs rapidly, save when it is dependent upon softening or tumors.	The loss of coördination of muscles comes on gradually—after months or years of pain. In its early stages, ataxia is commonly mistaken for rheumatism and neuralgia.
GAIT.	
The foot is dragged on the side rendered hemiplegic.	Both feet are equally affected. A peculiar "stamping gait" is developed. The legs are moved in various directions, without the will of the patient.

SYMPTOMS IN COMMON.

Both may be associated with abnormal sensory phenomena.
" " " " " " impairment of gait.
" " " " " " symptoms referable to impairment of cranial nerves.
" " " " " " electro-muscular reaction.
" " " " " " increase of galvanic excitability of muscles.
" " " " " " decrease of Farado-muscular contractility.

CEREBRAL EMBOLISM.	CEREBRAL THROMBOSIS.
SEX AFFECTED.	
Most frequent in females.	Equally frequent in the sexes.
CAUSES.	
A history of heart disease and the physical evidences of valvular lesion are usually to be discovered. The embolus may spring, however, from an aneurism or a suppurating thrombus and be carried in the circulation to the brain.	Atheroma. Syphilis. Pachymeningitis. Hyperinosis. Pyæmia. Pressure upon the veins or arteries These all tend to cause a coagulation of blood within the vessels affected.
CHANGES IN THE EXTERIOR OF SKULL.	
No changes in the vessels of the exterior of the skull are to be detected.	Epistaxis, œdema of the frontal veins, and exophthalmus may occur if the *superior longitudinal sinus* is obliterated.
The veins of the neck are symmetrical in point of size.	The external jugular veins are not of the same size—the one on the obstructed side being the smaller—if the *lateral sinus* be occluded. Painful circumscribed œdema behind the ear may arise from a thrombus of the *transverse sinus*.
SUPPURATIVE CHANGES.	
Suppurative effects are sometimes produced within the brain substance (embolic abscess), but seldom in distant parts.	*Suppuration of the ear* is very common in connection with thrombosis of the cerebral sinuses. *Abscesses in distant parts* are liable to form on account of a suppurative disintegration of the thrombi.
CONVULSIONS.	
Convulsions are rare.	Convulsive attacks are common and may exist for months, in attacks of venous thrombosis.

CEREBRAL EMBOLISM (*continued*).	CEREBRAL THROMBOSIS (*continued*).
PARALYSIS.	
A sudden hemiplegia usually occurs—generally of the *right side.*	Comes on gradually, if at all, in the venous variety. It may be absent.
Aphasia exists in the majority of cases.	May occur suddenly in arterial thrombosis. Aphasia may be developed, but is not the rule.
COMA.	
The patient seldom loses consciousness during the attack or after it.	Coma often follows the paralysis or accompanies the attack. In venous thrombosis, it may occur without paralysis having preceded it.

SYMPTOMS IN COMMON.

Both commonly affect the young and early adult life.
Both may cause aphasia.
Both may cause hemiplegia.

APHASIA.	GLOSSO-LABIO-LARYNGEAL PARALYSIS. (DUCHENNE'S DISEASE.)
EARLY SYMPTOMS.	
The loss of speech is usually sudden and only partially complete. The lips are under control and do not tend to separate.	Patient notices a slight impediment in speech early in the disease, or a tendency in the lips to separate and remain apart.
DEGLUTITION.	
Swallowing is not interfered with.	Swallowing is imperfectly performed later on in the disease. The palate becomes affected, and attempts at swallowing induce symptoms of strangulation.
FACE.	
The face is normal in expression.	Saliva dribbles constantly from the mouth, in the advanced stages of the disease; and the face is altered by the attitude of the jaw and the separation of the lips.
SPEECH.	
In the *ataxic variety*, speech is impaired in a variety of ways (page 483). In the *amnesic variety*, only the memory of words is lost.	The lingual and dental consonants are first pronounced with difficulty, and, later on, the labials.
MASTICATION.	
Mastication is performed as in health.	The food accumulates in the cheek during eating, as the tongue cannot control the bolus properly.
RESPIRATION.	
Respiration is not affected.	Respiration becomes impaired, from paralysis of the muscles necessary to that act. The patient often cannot cough or breathe deeply.

APHASIA (*continued*).	GLOSSO-LABIO-LARYNGEAL PARALYSIS (*continued*).
VOICE.	
The voice is normal.	Phonation becomes impossible, when the larynx is paralyzed.
ATROPHIC CHANGES.	
No atrophic changes in muscles occur throughout the disease.	As the disease tends to extend into the spinal cord and involve the cells of its gray matter, symptoms of muscular atrophy develop.
MOTOR PARALYSIS.	
The *right side* of the body is usually rendered hemiplegic.	Motor paralysis is not developed as a result of the spinal changes. The patient becomes unable to walk, however, as a result of general debility and the atrophy of the muscles.
MEMORY.	
The memory is impaired, in the amnesic variety, in respect to words, figures, foreign tongues, etc.	The memory of words is intact, but the ability to use the tongue and lips interferes with articulate speech.
DEMENTIA.	
Dementia seldom, if ever, occurs.	In exceptional cases, dementia develops late in the disease.

SYMPTOMS IN COMMON.

Both may be associated with impairment of the normal use of the tongue.

Both may be associated with defects of speech.

CEREBRAL SOFTENING.	CEREBRAL ABSCESS.
Exciting Causes.	
Embolism. Thrombosis. Blood poisons. Pressure of a localized character upon the brain substance from coexisting lesions. Traumatism.	Diseases of the internal ear. Injuries to skull or brain. Clot within the brain. Syphilitic disease of the bones of the head. Embolism. Erysipelas. Pyæmia. Encephalitis. Eruptive diseases—chiefly scarlet fever and small-pox.
Ear Symptoms.	
Softening is not commonly associated with disease of the temporal bone; hence aural symptoms are uncommon.	Aural pain, and other ear symptoms—particularly tinnitus aurium—are liable to exist if the lesion be in any way associated with disease of the temporal bone.
Pulse and Temperature.	
The pulse may be modified in some cases; but the temperature is not usually elevated.	If the abscess be due to causes which render its development rapid, the pulse and temperature will be markedly elevated.
Sensibility.	
Anæsthesia may coexist with the progressive paresis which develops; provided the softening is centrally located within the cerebral hemisphere.	Hyperæsthesia often exists in the early stages. Later on, anæsthesia may develop if the "sensory tract" of the cerebrum be involved. Painful cramps and lancinating pains are common if the abscess be due to encephalitis.

CEREBRAL SOFTENING (*continued*).	CEREBRAL ABSCESS (*continued*).
MOBILITY.	
Speech usually becomes impaired early in the disease, from lack of power over the tongue.	The tongue becomes affected, causing it to be frequently bitten during mastication; and, later on, articulation becomes indistinct and words are "slurred over" or clipped off.
Convulsions occur late, if at all, unless the lesion be cortical.	Muscular twitchings of the face and tonic or clonic spasms may be present.
Paralysis may develop slowly in *chronic* cases, or *rapidly* where the acute form exists or a hemorrhage occurs into a mass of brain substance previously diseased. In chronic cases paresis is more common than a well-marked hemiplegia.	General convulsions may occur.
	A hemiplegia slowly develops, beginning, as a rule, at some distant part of the body and extending gradually over one side.
Spasmodic twitchings of the limbs are infrequent.	The gait often becomes weak and of a shuffling character, and the body is inclined markedly forward.
EYES.	
Conjugate deviation of the eyes never (?) occurs, unless some other lesion exists that creates severe intra-cranial pressure; nor are the nerves of the orbit involved, as a rule.	*Conjugate deviation of the eyes* may be developed if an abscess of large size forms rapidly within the white centre of the hemispheres. The nerves of the orbit (second, third, fourth, and sixth cranial) may also be affected by pressure.
HEAD SYMPTOMS.	
A dull circumscribed headache (commonly referred to the frontal region) is usually present.	The headache is more intense.
Vertigo, and a sense of fullness, weight, or constriction in the head is often complained of.	
INTELLECT.	
A *progressive feebleness* of the intellect is a marked feature.	Coma follows too rapidly, as a rule, to allow of evidences of marked mental impairment.
Hallucinations and delusions of an evanescent type are common.	

CEREBRAL SOFTENING (*continued*).	CEREBRAL ABSCESS (*continued*).
AGE.	
Most common between 40 and 80.	May affect any age.
HISTORY.	
That of embolism or thrombosis exists in a very large percentage of cases.	That of any of the causes enumerated. The history is of great value in forming the diagnosis.

SYMPTOMS IN COMMON.

Both may be associated with motor paralysis.
" " " " " sensory paralysis.
" " " " " pain in head.
" " " " " coma.
" " " " " convulsions.

EXTERNAL PACHYMENINGITIS.	INTERNAL PACHYMENINGITIS. (HÆMATOMA OF THE DURA MATER.)
CAUSES.	
Traumatism of the calvaria. Diseases of the cranial bones. Caries and necrosis of the cervical vertebræ. Suppurative diseases of the vertebral ligaments. Rarely follows syphilitic or rheumatic conditions of the cranium or erysipelas of the scalp.	Chronic alcoholism and syphilis. Acute febrile disorders (fevers, rheumatism, and puerperal diseases). Chronic diseases of the heart, tuberculosis, and the paralysis of the insane may be associated with it. Old age. Males more frequently affected than females.
HEADACHE.	
Intense and circumscribed headache usually exists.	Periodical headache is commonly produced; gradually reaching extreme intensity if the acute form exists.
CONVULSIONS.	
Slight convulsions are common at the onset.	Convulsions are rare.
BRAIN SYMPTOMS.	
Vertigo, nausea, and vomiting are frequently met with at the onset of the disease.	Weakness of memory, apathy, somnolence, and delirium are the more common symptoms.
PUPILS.	
The pupils become unequal, if the pressure upon the brain is severe.	The pupils are not usually affected, because the pressure of the sanguineous cyst is more limited than that of a pus exudation.

EXTERNAL PACHYMENINGITIS (*continued*).	INTERNAL PACHYMENINGITIS (*continued*).
PULSE.	
The pulse is at first accelerated, but becomes slow and irregular when cerebral compression is produced.	The pulse fails to exhibit the effects of general cerebral compression, except in severe and fatal cases.
LATE SYMPTOMS.	
Coma and paralysis follow if cerebral compression or abscess is produced.	Feebleness of the limbs, unsteady gait, and changes in the nutrition, indicate the latent progress of inflammation of the brain.

SYMPTOMS IN COMMON.

Both may be associated with headache.
" " " " convulsions.
" " " " coma.
" " " " paralysis.
" " " " syphilitic history.

CEREBRAL TUMORS.	CEREBRAL SOFTENING.
HEADACHE.	
Headache usually exists in the frontal or temporal region; occasionally in the occipital region. It is either intermittent or paroxysmal at first; but it tends to become continuous and rebellious to treatment. It is not necessarily over the seat of the tumor.	Headache is less severe, and usually confined to the frontal region. Paroxysms of pain in the head are less frequent. It is more commonly continuous.
VERTIGO.	
Vertigo is quite a frequent symptom in connection with the headache. If the tumor is within the temporal bone, the vertigo is especially severe.	Vertigo is not specially characteristic of cerebral softening.
EARLY EFFECTS OF LESION.	
Disturbances in both sensation and motion are developed when the brain is subjected to irritation or is pressed upon by the tumor.	The mental faculties exhibit impairment early. Later in the disease the body may be suddenly rendered hemiplegic and aphasic.
SENSORY PHENOMENA.	
The sensory disturbances which develop include neuralgic attacks; numbness; formication; reflex cramps, etc. These are subsequently followed by more or less anæsthesia.	Sensory symptoms, when present, are not as marked as in tumors. In some situations, cerebral softening does not induce them.

CEREBRAL TUMORS (*continued*).	CEREBRAL SOFTENING (*continued*).
Motor Phenomena.	
The motor phenomena which are induced comprise: stiffness of the muscles; a relaxed condition of one member or limb; spasms of the tonic or clonic type; tremor; permanent contraction of muscles; paresis; monoplegia; hemiplegia; paraplegia, etc.	Hemiplegia (which is usually of sudden origin and complete) is more common than in tumors.
Crossed paralysis in any of its more common forms may occur.	Aphasia is also often developed with the hemiplegia.
Double or alternate paralysis, when present, is specially characteristic of tumors.	Double or alternate paralysis is rare.
Special Senses.	
Anosmia, amblyopia, amaurosis, choked disc, auditory disturbances, and loss of taste have all been observed to follow the development of cerebral tumors.	Disorders of the special senses are less frequent than in tumors; when present, they do not tend to progressively involve one special sense after another.
Speech.	
Is infrequently affected as true aphasia. The speech is often embarrassed, however, by sputtering, imperfect utterance, etc.	Is frequently affected. When so, the condition of true aphasia is commonly present.
Mental Faculties.	
Impaired late, if at all.	Impaired early.
Etiology.	
Tuberculosis, cancerous cachexia, syphilis, and diseases which induce changes in the cranial bones, are frequent causes of tumors within the skull.	Frequently follows disease of the temporal bone; if so, it is preceded by aural disturbances.
	Embolism, cerebral thrombosis, and apoplexy, are frequent causes of cerebral softening.

SYMPTOMS IN COMMON.

Both may be associated with headache.
" " " impairment of mental faculties.
" " " " " motion.
" " " " " sensation.
" " " " " speech.
" " " " " special senses.

CEREBRAL HEMIPLEGIA.	SPINAL HEMIPLEGIA.
FORM OF ATTACK.	
Onset usually sudden. Consciousness is often lost when the lesion is centrally situated in the hemispheres.	Onset may be gradual. Consciousness is not lost.
HISTORY.	
That of some *cerebral disease*, such as apoplexy; embolism; softening; tumor, etc.	That of some *spinal lesion* situated in the cervical region, and involving only one *lateral half* of the spinal cord.
PUPILS.	
Are liable to be irregular.	Are unaffected, unless the cilio-spinal centre within the cervical region of the cord be involved. If so, the "Robertson pupils" may exist.
OPHTHALMOSCOPIC EXAMINATION.	
May reveal the "choked disc."	Negative.
CRANIAL NERVES.	
The cranial nerves are frequently involved, causing paralytic symptoms—commonly in the nostril, eye, or face. The spinal senses are often modified.	The cranial nerves are not involved, unless a sclerosis of the cord extends upward late in the disease.
Crossed paralysis (in any of its forms) may be present.	Crossed paralysis is never present.
REFLEX PHENOMENA.	
Are usually normal.	The various reflexes are liable to be impaired or lost.
SPASMODIC PHENOMENA.	
The paralyzed muscles are not rendered particularly susceptible to spasm.	Spasms of the limbs are very frequent.

CEREBRAL HEMIPLEGIA (*continued*).	SPINAL HEMIPLEGIA (*continued*).
ELECTRO-MUSCULAR PHENOMENA.	
Usually normal.	Modified according to the parts of the cord which are affected by the lesion.
SENSORY PHENOMENA.	
Anæsthesia or Analgesia, when they exist are on the *same side as the motor paralysis.*	Anæsthesia or Analgesia, when present, are on the *side opposite to the motor paralysis.* Sensations of burning, pricking, formication, coldness, and heaviness often exist at the onset. Hyperæsthesia follows. Subsequently anæsthesia is developed.
RESPIRATION.	
Respiration is seldom affected.	Difficulty in breathing is often experienced when the spinal lesion is above the origin of the phrenic nerve.
SPHINCTERS.	
The sphincters are not involved, as a rule.	The vesical and anal sphincters are often affected with inertia or paralysis.
SEXUAL FUNCTIONS.	
The sexual power is commonly retained.	The sexual power is often abolished.

SYMPTOMS IN COMMON.

Both are associated with hemiplegia.
Both may be associated with abnormal sensory phenomena.

MULTIPLE CEREBRAL SCLEROSIS.	PARALYSIS AGITANS. (SHAKING PALSY.)
AGE OF PATIENT.	
Most common between 20 and 30 years of age.	Occurs in advanced age.
ETIOLOGY.	
Intense and prolonged action of cold (by affecting the vessels). Mental excitement or anxiety. Excessive mental labor.	Intense and prolonged action of cold. Mental shocks or excessive excitement. Severe pain.
EARLY SYMPTOMS.	
Nausea. Headache. Vertigo. Syncope. Apoplectiform attacks.	Chronic insomnia. Marked irritability of temper. Muscular contractions. Localized tremor. Weakness of the limbs.
EYE SYMPTOMS.	
Double images (diplopia). Indistinct vision (amblyopia). Nystagmus.	Diplopia is seldom produced. Amblyopia " " Nystagmus is not developed.
INTELLIGENCE.	
Is impaired gradually.	Usually unaffected, as a rule; unless as an evidence of the approaching fatal termination.
SPEECH.	
Is often impaired late in the disease. It usually becomes slow and syllabic.	Articulate speech is not seriously impaired, as a rule; but, if a tremor of the tongue exists, it makes distinct pronunciation difficult.

MULTIPLE CEREBRAL SCLEROSIS (*continued*).	PARALYSIS AGITANS (SHAKING PALSY) (*continued*).
PUPILS.	
Are often irregular.	Not usually affected.
SPINAL SYMPTOMS.	
Are seldom absent, because the cord is simultaneously affected. They include the following: Fatigue from slight exertion. Paroxysms of pain. Coldness of the limbs. Increased reflex excitability. Gradual paresis, especially of the thighs. Slow, trembling gait. Tremor is sometimes developed.	A tendency to run or fall forward or backward. Hyperæsthesia over certain parts of the spinal column. The reflex excitability is not increased. The fingers and toes are deformed on account of muscular rigidity. The patient leans towards the paralyzed side when walking, and inclines the trunk forward. *Rhythmical tremor* of one *lateral half* of the body exists—propagated from the upper to the lower limb, and increased by muscular effort or excitement. General paralysis is developed late in the disease.

SYMPTOMS IN COMMON.

Both may be associated with tremor.
" " " " " impairment of speech.
" " " " " a history of mental anxiety or of excessive mental labor.
" " " " " paresis or paralysis of the extremities.

MENIÈRE'S MALADY. (AUDITORY VERTIGO.)	EPILEPSY.
EAR SYMPTOMS.	
marked defect in the acoustic apparatus is always to be detected. This is probably the exciting cause of the development of later symptoms.	Acoustic defect is either absent, or, when present, is probably not connected with the convulsive attacks.
AURA.	
No special warning of the attack is given the patient.	The patients are forewarned of the approach of the attack by some peculiar symptoms which differ with each case.
VOMITING.	
Is characteristic of the attack.	Is seldom present.
CONSCIOUSNESS.	
Is not usually lost.	Is lost during the convulsion—except in the so-called "*petit mal*."
SPASMODIC PHENOMENA.	
Are absent during the attack.	Are always present during the attack. They are *tonic* at first, but become *clonic* in character later.
VERTIGO.	
Is intense and is the most prominent symptom. Lying down fails often to relieve it.	Is seldom present. After the attack, the patient is stupid and desires to sleep.
HISTORY.	
No exciting cause can be discovered, excepting the auditory defect.	In some cases, a hereditary predisposition exists. Excessive venery, masturbation and syphilis tend to induce it.

HYDROCEPHALUS (CHRONIC VARIETY).	HYDROCEPHALUS (CONGENITAL VARIETY).
AGE AFFECTED.	
May follow the acute form in infants. May be developed in middle life from occlusion of the sinuses or from tubercle, meningitis, tumors, etc. In old age, it may accompany cerebral atrophy, or insanity.	Exists at birth or develops rapidly after birth.
EARLY SYMPTOMS.	
Special senses become blunted. Head becomes heavy and droops. The face indicates an impairment of intelligence.	A marked contrast exists between the increased volume of the skull and the small dimensions of the face. The head is not held erect.
FACIAL SYMPTOMS.	
Paresis of the facial nerve develops. Ptosis is commonly met with. The pupils become unequal.	Facial paralysis is rare. Ptosis and strabismus are frequently associated. The pupils are dilated and react feebly to light.
SPEECH.	
Speech becomes difficult.	Speech is seldom perfectly developed.
MENTAL FACULTIES.	
The symptoms of idiocy develop.	The mental faculties are markedly enfeebled. Idiocy may be developed.

HYDROCEPHALUS (CHRONIC VARIETY) (*continued*).	HYDROCEPHALUS (CONGENITAL VARIETY) (*continued*).
GAIT.	
The gait becomes tottering and uncertain.	The power of walking is developed late and imperfectly.
CONVULSIVE ATTACKS.	
Epileptiform attacks are not infrequent.	Convulsions and contractures of muscles are commonly met with.
COMA.	
Develops whenever the cerebral compression becomes excessive.	Is a frequent precursor of death. Is due to cerebral compression.

SYMPTOMS IN COMMON.

Both may be associated with the tubercular diathesis.
" " " " ptosis.
" " " " impairment of speech.
" " " " enfeebled intellect.
" " " " abnormal gait.
" " " " convulsions.
" " " " coma.

DISEASES

OF THE

SPINAL CORD AND ITS ENVELOPES.

DISEASES OF THE SPINAL CORD.

LESIONS OF THE SPINAL CORD.

The abnormal conditions of the spinal cord may be variously classified. Perhaps one of the simplest is that based upon the physiological functions of certain parts. The one adopted by the author is of that character.

The spinal cord exhibits certain pathological changes which tend to *progress along definite tracts of nerve-fibres* without spreading laterally. These are termed "*systematic lesions.*" Again, certain diseased conditions of the cord tend to *spread in a transverse direction* and thus involve one column after another. These are termed "*focal lesions.*"

Before we attempt to consider the various diseases of the cord in detail it may be well to enumerate the more common ones.

A TABLE OF THE ABNORMAL CONDITIONS OF THE SPINAL CORD.

- "SYSTEMATIC LESIONS" OF THE MOTOR TRACTS OF THE CORD, or the so-called "*kinesodic system.*"
  - Sclerosis of the anterior columns.
  - Sclerosis and degeneration of the lateral columns (*tetanoid paralysis*).
  - Myelitis of the anterior horns of gray matter (*atrophic spinal paralysis*).
  - Degeneration of the cells of the anterior horns (*progressive muscular atrophy*).
  - Pseudo-hypertrophic paralysis.
  - Amyotrophic lateral sclerosis.
  - Central myelitis.
- "SYSTEMATIC LESIONS" OF THE SENSORY TRACTS OF THE CORD, or the so-called "*æsthesodic system.*"
  - Sclerosis of the columns of Goll and Burdach (*locomotor ataxia*).
- CONGENITAL ABNORMALITIES.
  - Absence of the spinal cord (see page 463).
  - Spina bifida (see page 456).
  - Incomplete development of the spinal cord.
- "FOCAL LESIONS" OF THE CORD.
  - Inflammatory conditions of the spinal meninges.
  - Degenerations of the cord.
  - Depressed bone.
  - New growths of the bone or meninges.
  - Hemorrhage of the cord.
  - Tumors of the cord.

Certain general axioms must form the basis of our ability to diagnose the existence of spinal lesions and the regions of the cord which are affected by them. They may be expressed as follows:

1. Lesions which involve the "*kinesodic system*," or motor tracts, may induce *paresis* or *paralysis*, *spasm*, and *atrophy of muscles*. They never cause anæsthesia, numbness, marked and permanent pain, or other sensory phenomena.

2. Lesions of the "*œsthesodic system*," or sensory tracts, cannot induce paresis, paralysis, spasm, or muscular atrophy. They can only create *sensory manifestations* (such as *pain*, *hyperœsthesia*, *anœsthesia*, *numbness*, etc.), and an *inability to coördinate muscular movements* (*ataxia*).

3. *Paralysis* and *atrophy*, when due to spinal causes, occur upon the *same side* of the body as the spinal lesion; and the same may be said of *ataxia*.

4. *Sensory phenomena* are manifested upon the side of the body *opposite* to the spinal lesion.

5. The so-called "*cincture feeling*," which may be referred to various parts of the body, can be taken as a valuable guide in deciding as to the probable limits of a focal lesion.

6. *Contracture of paralyzed muscles* is strongly diagnostic of lesions of the corresponding *postero-lateral column* of the cord.

7. *Atrophic changes in muscles* point toward a lesion of the cells of the corresponding *anterior horn* of the spinal gray matter.

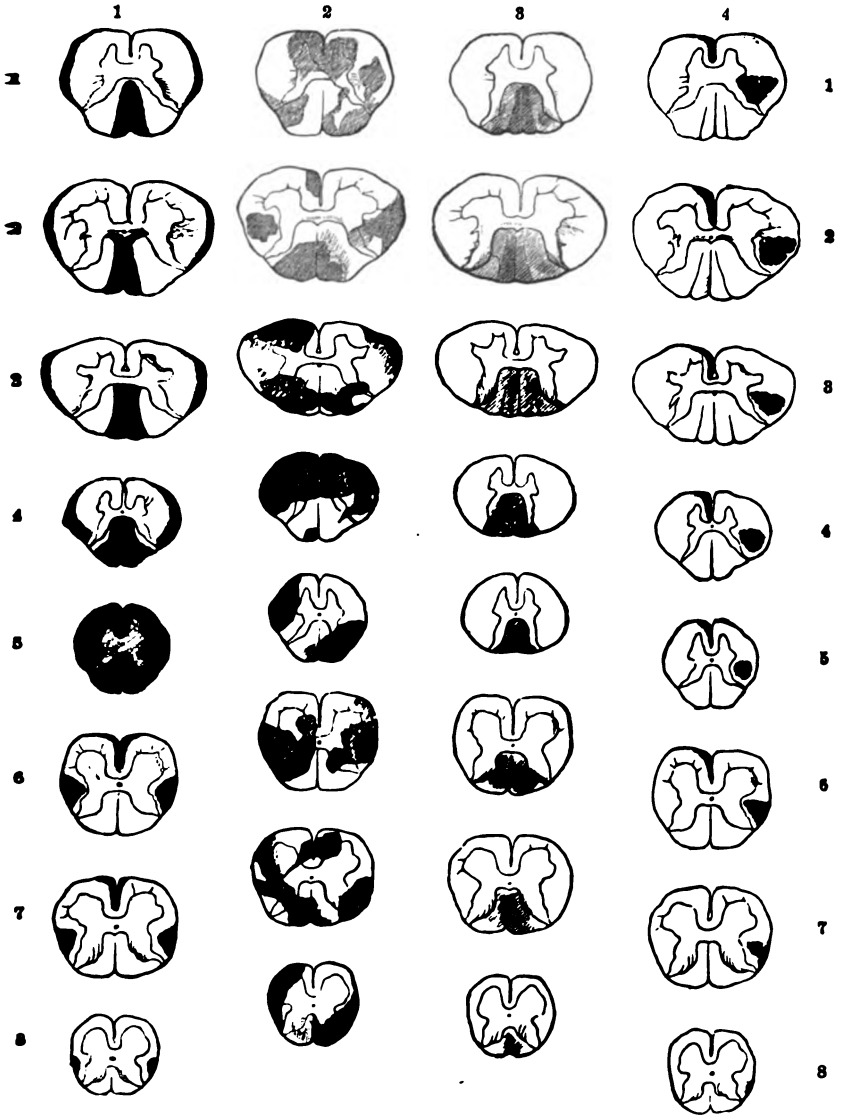
8. Symptoms indicative of destruction of any of the *special physiological centres* of the spinal cord are of value in determining the extent of both systematic and focal lesions of the cord.

9. Destructive lesions of certain parts of the brain tend to induce a descending degeneration of the fibres which pass chiefly down the postero-lateral column of the opposite side of the cord.

10. Scratching or stroking the skin over certain regions of the body causes a reflex contraction of special muscles when the cord is healthy. These are the so-called "*superficial spinal reflexes*." They are of value oftentimes in deciding as to the upper limits of a lesion. Among the more important of these superficial reflexes may be enumerated the plantar, cremasteric, abdominal, epigastric, and scapular. Both cerebral and spinal lesions create in them modifications, which possess clinical value.

11. The so-called "*deep spinal reflexes*" are called into action by first putting a muscle in a state of moderate tension, and then exciting it to contraction by some artificial stimulus, as a slight tap or blow for example. Among the more important of these may be

PLATE XXVI.



1. *Myelitis transversa dorsalis, with secondary ascending and descending degenerations* (half schematic). Seat of the lesion at the height of section 5. Above this (1 to 4), secondary *ascending* degeneration in Goll's columns and the direct cerebellar tracts of the lateral columns. Below the lesion (6 to 8), *secondary descending degeneration* in the pyramidal tracts of the lateral and anterior columns.

2. Semi-diagrammatic representation of the changes in *multiple sclerosis*, as seen in sections made at different levels of the cord. The dark spots represent the sclerotic nodules.

3. *Sclerosis of the posterior columns.* Half diagrammatic. The most marked development is shown in the upper lumbar and the thoracic portion. In the cervical portion there is a less uniform involvement of the posterior columns.

4. *Secondary descending degeneration of the pyramidal tracts* in primary lesion of the *left* half of the cerebrum. The pyramidal tracts of the lateral columns of the *right* side of the cord are degenerated down to the lowest portion of the lumbar division (1 to 8); the pyramidal tracts of the anterior columns of the *left* side are degenerated as far down as the beginning of the lumbar enlargement (1 to 6).

mentioned: (1) The knee-jerk or patella-reflex; (2) the foot- or ankle-reflex; (3) the peroneal or lateral foot-reflex. These tests are employed, like the preceding ones, to determine the state of the spinal cord when the existence of a lesion is suspected. They may be increased, diminished, or abolished, according to the character of the lesion.

12. Pain in the region of the spine is a rare symptom of disease of the spinal cord. It is more frequent in diseases of the bones or meninges.

In addition to these pathological axioms, certain *physiological deductions* respecting the spinal cord may be thus summarized:

(1.) The *anterior* and *postero-lateral columns* of each side contain only *motor fibres*. Those in the former (Türck's columns) are connected with the *corresponding cerebral hemisphere;* while those of the latter are connected with the *opposite cerebral hemisphere.*

(2.) The *posterior column* of each side (comprising two portions—that of Goll and Burdach) serves to convey *sensory nerve fibres* and also *commissural fibres* (?) which connect different segments of the cord; hence they are physiologically associated both with *sensation* and the *coördination* of *muscular movement.*

(3.) The *lateral column* of each side probably conveys *vaso-motor fibres.* It has been proven to convey fibres also directly to the cerebellum (the "*direct cerebellar column*").

(4.) The *multipolar nerve-cells* in the *anterior horn* of the spinal gray matter possess a "*trophic function.*" When they are destroyed, the *nerve-fibres* arising from them and the *muscles* also which are supplied by those fibres, undergo *atrophy.*

(5.) The fibres of the anterior and postero-lateral column have their "trophic centre" in the motor area of the cerebral cortex. Any lesion which tends to sever these fibres from this centre creates a descending degeneration of all the nerve-fibres so disconnected as far as their ultimate distribution to other segments of the cord below the lesion.

(6.) The *spinal nerves* may be regarded as guides to the *various segments* of the spinal cord; each segment consisting of a disc of the cord of sufficient thickness to include a separate pair of spinal nerves which are attached to it.

(7.) Each *spinal segment*, with its attached nerves, may be figuratively regarded as a distinct spinal cord for that limited portion of the body to which its nerves are distributed, viz., the *muscles* to which the anterior roots of the spinal nerves proceed, and the *parts supplied with sensation* by means of the posterior roots of the same.

(8.) The *superimposed segments* of the cord are bound together by *tracts of nerve fibres*. Some of these are *continued into the brain*, while others are *purely commissural in type*. We can attribute to the former (the motor and sensory tracts) the conduction of motor impulses from the brain to the various spinal segments, and, again, of impressions of a sensory character from the periphery of the body to the brain itself. The latter (commissural fibres) serve to assist the different spinal segments in the performance of all acts where a *harmonious* and *simultaneous action* of *several segments* of the spinal cord is demanded.

(9.) The two *lateral halves* of each segment of the spinal cord are not distinct from each other, because a connecting band of the gray substance of the cord (gray commissure), and also one of the white substance (white commissure), bind them together. The white commissure lies at the bottom of the anterior median fissure; the gray commissure fills the remaining space between the anterior and posterior median fissures.

(10.) The *anterior horns* of the spinal gray matter contain *cells of large size* which are connected (1) with motor nerve-fibres joining each spinal segment with the brain, and (2) with fibres of the anterior root of the spinal nerve associated with the muscles controlled by each segment. Thus these nerve-cells are interposed between the fibres of the cord and those of the muscles; an arrangement which permits of an automatic action of the cord, irrespective of cerebral influences.

The *cells of the anterior horns* appear to control the *nutrition of the muscles* connected with them by means of the nerve-fibres.

(11.) The *cells of the posterior horns* of the spinal gray matter are probably connected more or less intimately with the fibres of the *posterior or sensory roots of each spinal segment*, and also with the *paths of sensory conduction* to the brain. They do not exert any influence upon the nu-

trition of the parts associated with them by means of the spinal nerve-fibres.

(12.) The *spinal reflexes* are probably performed by means of an anastomosis of the processes of the cells of the anterior and posterior horns of each lateral half of a spinal segment. This enables a *sensory impression*, which is conveyed to the spinal segment by means of the fibres of the posterior root of the spinal nerve, to become transformed into *motor impulses* in the cells of the anterior horn and then transmitted to the muscles by the fibres of the anterior root of the spinal nerve. These reflexes will be considered in detail later.

Spinal paralysis may assume one of four varieties:

(1.) Hemiplegia—where one *lateral* half of the body is affected.
(2.) Paraplegia—where the *lower half* of the body is affected.
(3.) Hemi-paraplegia—where the *lower half* of *one lateral half* of the body is affected.
(4.) Paralysis of special nerve-roots.

The *sensory phenomena*, which may be produced by lesions of the spinal cord, include the following:

1. Pain, usually of a peculiar kind (see locomotor ataxia).
2. Hyperæsthesia, or increased sensibility of parts.
3. Numbness.
4. Sense of coldness.
5. Anæsthesia, or loss of sensibility. It may be complete or partial.
6. Delayed sensation (see locomotor ataxia).
7. Formication, or a feeling likened to the crawling of ants over the body.

Among the remaining symptoms which are of value in the diagnosis of spinal lesions may be mentioned:

(1.) Incoördination of muscular movements.
(2.) Diminution, abolition, or increase of the spinal reflexes.
(3.) Abnormal electro-muscular reactions.
(4.) Contracture of muscles (often preceded by stiffness).
(5.) Atrophy of muscles.
(6.) Vaso-motor phenomena.
(7.) Effects of destruction or irritation of some of the special physiological centres of the spinal cord.

We are now prepared to discuss the separate lesions enumerated in the table of diseases of the spinal cord. The scattered hints which have been already given will possibly help us to grasp the salient features of each, and their physiological interpretation.

In examining a case of paralysis of spinal origin, the following points should be ascertained with great care:

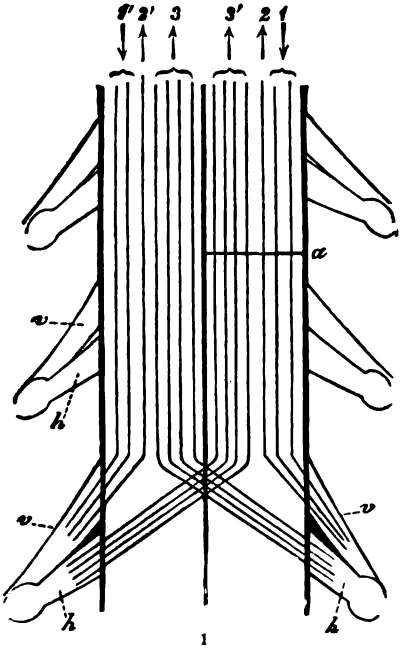
1. The *area of distribution* of the paralysis (sensory or motor).
2. The *degree of the paralysis;* by testing the motor power of the different sets of muscles, and the skin also for sensory paralysis.
3. The *state of nutrition* of the paralyzed muscles (see poliomyelitis and progressive muscular atrophy).
4. The *electrical reactions* of the paralyzed muscles; noting all abnormal formulæ of reaction and also the intensity of the current required to produce muscular contraction.
5. The presence or absence of *rigidity* in the paralyzed muscles (see sclerosis of lateral columns).
6. The condition of the *superficial* and *deep spinal reflexes.* These will be described later.
7. The presence or absence of symptoms of *incoördination of muscular movements* (see locomotor ataxia).

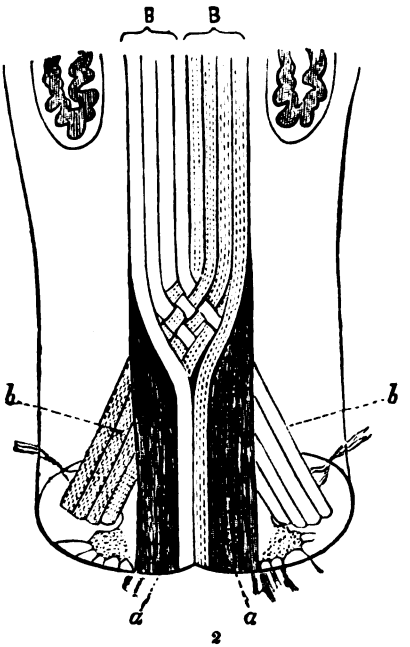
SCLEROSIS OF THE ANTERIOR COLUMNS.

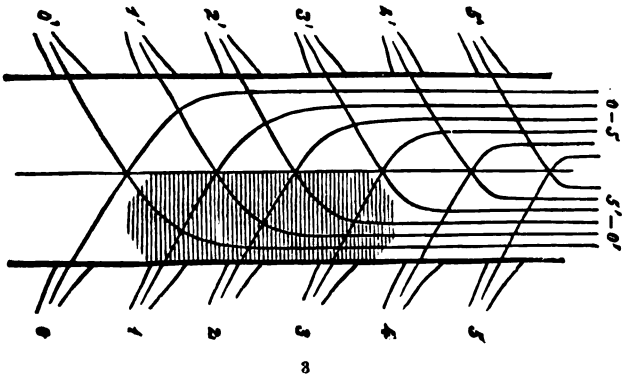
The anterior columns of the cord have been also named "*the columns of Türck*" and "*the direct pyramidal fasciculi.*" The first was given in honor of the distinguished pioneer in pathological research of spinal lesions; the latter, because the bundles which compose these columns pass directly from the hemisphere of the cerebrum to the ultimate spinal segments without decussating in the medulla.

Sclerosis of these bundles of nerve fibres usually coexists with similar changes in those which compose the postero-lateral column of the cord, or the so-called "crossed pyramidal fasciculi." It may occasionally exist as an independent lesion. The symptoms which are characteristic of its development are unknown. Its existence is to be inferred, however, when sclerosis of the postero-lateral columns is manifested by symptoms which are clinically well determined. The pathological changes of sclerosis of the cord do not differ from those of that condition elsewhere. They have been described in the preceding chapter, in connection with the brain.

PLATE XXVII.







1. Schematic representation of the course of the principal tracts within the spinal cord belonging to one pair of nerves. *v*, anterior, *h*, posterior root. 1, motor and vaso-motor tracts. 2, tracts for muscular sensibility. 3, tracts for cutaneous sensibility on the right side; 1', 2', 3', the same on the left side. The arrows indicate the direction of physiological conduction.

2. Diagram of the motor decussation. Transparent longitudinal view of the medulla, with only the anterior and the decussation of the postero-lateral columns left. *a*, *a*, anterior columns; *b*, *b*, pyramido-postero-lateral columns; the pyramidal columns of the right side (*c*) arising from the left lateral column, and reinforced by a slender bundle from the right anterior column, are left unshaded, those of the left side are dotted. The part of the anterior columns which disappears behind the pyramids, is shaded with vertical lines.

3. Diagrammatic representation of the lesion of sensitive tracts in unilateral lesion of the right side, to the extent of the shaded space. All sensitive tracts of corresponding height, as well as those coming from further back on the *left side*, are interrupted. On the *right side* only those are interruptod which enter by the roots from 1 to 3.

Numbers 0 to 5 represent the sensitive tracts of the right side, entering with the posterior roots; 0' to 5' the same on the left side.

SCLEROSIS OF THE POSTERO-LATERAL COLUMNS.

(TETANOID PARAPLEGIA—SPASTIC PARALYSIS—SPASMODIC TABES.)

The crossed pyramidal fasciculi of the spinal cord decussate in the medulla, and are therefore associated with the opposite cerebral hemisphere. They occupy only a portion of the lateral column of each half of the spinal cord, lying close to the posterior horn of the spinal gray matter and separated from the periphery of the cord by the so-called "direct cerebellar column." The size of this important area decreases gradually from the cervical enlargement of the cord till it ends in the lumbar enlargement. It is the only portion of the lateral column of the cord whose function is as yet definitely known.

When sclerosis of this tract commences, it tends to extend throughout its entire extent, but it does not usually spread transversely to other adjoining bundles.

It may exist as a primary lesion; or it may occur as a result of other morbid processes which tend to cut off the fibres which compose it from the trophic centres of the motor area of the brain (secondary degeneration). Myelitis of the anterior horns of the spinal gray matter may also induce it.

PRIMARY LATERAL SCLEROSIS.

The clinical picture which results from this condition is characterized by a slowly progressive paresis which affects the lower limbs first and subsequently the upper; an increase of the spinal reflexes; and a state of late rigidity in the paralyzed muscles. No atrophic changes in the paralyzed muscles are induced. Anæsthesia is not present, nor are there any pronounced sensory phenomena. Both of the lower limbs are usually simultaneously affected. The stiffness in the legs compels the use of two canes when attempts at walking are made. The patient moves with the most extreme difficulty, and the feet appear to be firmly fastened to the ground when an advanced step is made. The pelvis and the limb as a whole is lifted. The toes are dragged along the ground with a scraping noise. The knees frequently become interlocked, and the foot tends to cross its fellow as it is brought forward. The muscles of the calf sometimes become affected with spasm during attempts at walking; a peculiar "hopping gait" is then observed after the foot is raised from the ground. When the muscles are manipulated they become tense and rigid.

The *electrical reactions* of the affected muscles are normal or slightly decreased.

The deep spinal reflexes, especially the knee and ankle clonus, are exaggerated; the superficial reflexes are sometimes decreased or abolished, although they may be exaggerated. The tests employed to determine the condition of the spinal reflexes will be given later.

After the lapse of several months or years, the patients are obliged to confine themselves to bed from an inability to walk. The legs then remain stiffly extended; the thighs are closely approximated, as the result of spasm of the adductor muscles; and the feet are usually inverted. The upper extremities ultimately become affected in the same manner as the legs.

The bladder and rectum are not affected, as a rule; the viscera are healthy; and cerebral complications are rarely, if ever, developed.

An increased susceptibility to cold is commonly observed in this class of patients.

In rare instances, one leg alone may be affected; or one leg and one arm. Such cases are to be diagnosed from hemiplegia of cerebral origin.

Primary lateral sclerosis should be diagnosed from the secondary form, and from amyotrophic lateral sclerosis. The symptoms of each will be found (arranged in tables of contrast) later in the chapter.

Secondary Lateral Sclerosis.

In connection with both cerebral and spinal lesions, a secondary sclerosis of the crossed pyramidal fasciculi may be developed. In either case, the fibres which compose these bundles must have been severed from their connection with the trophic centres of the cerebral convolutions.

The *cerebral lesions* which produce it must affect one of the following parts; (1) the convolutions of the so-called "excitable district" of the brain, which are chiefly motor in function; (2) the anterior two-thirds of the internal capsule; (3) the caudate nucleus; (4) the basis cruris cerebri; or (5) the anterior pyramids of the medulla, above the point of decussation of the motor tract of fibres.

Secondary sclerosis produces the same symptoms as the primary form, and it must be diagnosed from it by its comparatively rapid development and the paralytic symptoms which exist to a marked degree before the stiffness and contracture of the muscles. The

bladder and rectum are more commonly affected, and the skin sometimes exhibits trophic disturbances.

This form of sclerosis is to be diagnosed also from a chronic myelitis which involves the crossed pyramidal bundles, and those diseases which tend to produce a gradual compression of the spinal cord, such as meningitis, tumors, etc. It is far more frequent than the primary variety. The history of the case will often point to some cerebral lesion as its exciting cause.

MYELITIS OF THE ANTERIOR HORNS.

(Poliomyelitis Anterior) of Infants and Adults.

The *ganglion cells of the anterior horns* of the spinal gray matter may be affected by inflammatory processes which lead to their atrophy or destruction. The cells seem to become involved in an acute pigmentary degeneration. The name poliomyelitis (*πολιός*, gray, and *μυελος*, marrow) expresses the seat of the lesion.

As a result of these changes within the cells, the spinal nerve-fibres which are connected with them degenerate; and the muscles that are supplied by those nerve-fibres undergo atrophy. This seems to be clinical evidence in support of the view that the ganglion-cells of the anterior horns of the spinal gray matter preside over both muscular movement and the nutrition of the tissues connected with them by means of the nerves.

The inflammatory changes observed in the anterior horns of the spinal gray matter must not be confounded with non-inflammatory degeneration of the ganglion-cells which is associated with progressive muscular atrophy.

Poliomyelitis anterior may be described as of three varieties—the acute, subacute, and chronic. It is more common in children than in adults, although the chronic variety is less frequent in children than the acute.

Acute Form (*infantile spinal paralysis—acute spinal paralysis of adults*).

This form is ushered in by a sharp elevation of temperature, which may be either continued or remittent. It lasts several days, and may be accompanied by pains in the limbs, muscular twitchings, tremors, convulsions, delirium, and occasionally by a sense of numbness. An extensive and sudden paralysis (which attains its height at the onset) follows, and the fever simultaneously disap-

pears. The form of the paralysis varies. It may affect all of the limbs (complete paralysis); or, again, it may be confined to two (hemiplegia or paraplegia), or sometimes only one (monoplegia). It rapidly diminishes spontaneously, but never entirely disappears. It is not accompanied by anæsthesia, nor is the bladder or rectum involved. The numbness occasionally persists after paralysis has developed.

The fever which accompanies the initial stage is to be explained by the inflammatory action which induces the paralysis, and is a valuable point in the differential diagnosis of this affection.

Soon after the onset of the paralysis, the paralyzed muscles of the limb affected (some usually escape paralysis) cease to respond to the faradic current; but they contract slowly and with abnormal formula when the galvanic current is employed—thus exhibiting the evidences of degeneration.

When several weeks have elapsed, signs of atrophy begin to be apparent in the paralyzed muscles. In some instances, the atrophic changes may be confined to a special group of muscles supplied by one nerve. In all cases, the atrophy of the muscles is progressive and permanent.

Although this variety is commonly described as "infantile spinal paralysis," because children are more often affected by it than adults, it is still met with in adult life, but rarely in old age. Prévost and Charcot were the first observers to discover the exact pathological changes which occurred in the anterior horns.

Subacute Form.

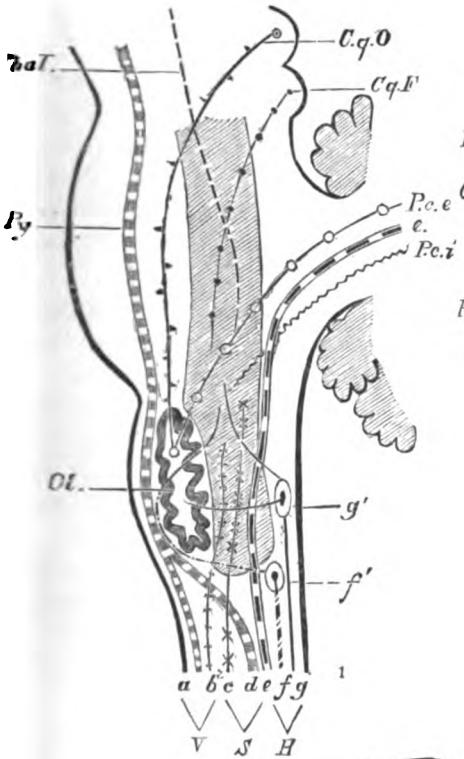
This is a rare type of disease, and affects adults exclusively. It differs from the acute variety in the gradual onset of the paralysis; the absence of cerebral symptoms; the presence of only slight febrile excitement; and the fact that it does not affect the period of childhood. It is to be diagnosed from the acute form, lead paralysis, and progressive muscular atrophy.

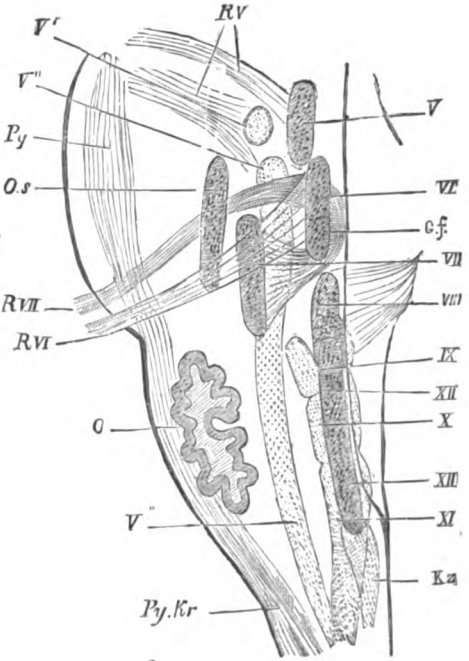
Chronic Form.

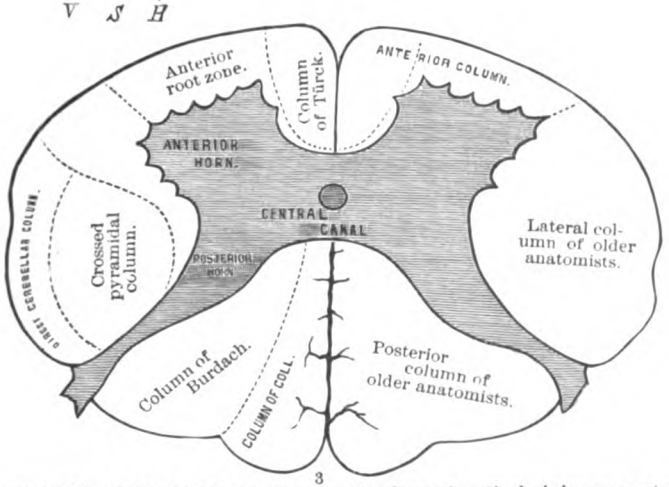
When the anterior horns are affected with a chronic type of inflammation, the symptoms closely resemble those of progressive muscular atrophy. It is a rare form of disease, and may attack children or adults.

The points which are peculiarly diagnostic of this condition are (1) *severe neuralgic pains* which precede the atrophic changes in the muscles, and which last for weeks or months before the muscles

PLATE XXVIII.







1. Diagram of the chief tracts in the medulla. The formatio reticularis is represented by shading. *Ol*, olivary body; *V*, anterior; *S*, lateral, and *H*, posterior spinal funiculi; *a*, pyramido-anterior tract; *d*, pyramido-lateral tract; *Py*, pyramidal tract; *b*, remainder of anterior column; *c*, remainder of the lateral column; *e. e*, cerebello-lateral tract; *f*, funiculus gracilis; and *f'*, nucleus of the same; *g*, funiculus cuneatus, and *g'*, nucleus of the same; *P. c. i*, internal fasciculus of the pedunc. cerebelli; *P. c. e*, external fasciculus of the same; *C. q. F*, tract from corp. quadr. to format. retic.; *C. q. O*, the same to the olivary body; *Thal*, tract from the thalamus opticus.

2. Transparent lateral view of the medulla, showing the relative positions of the most important nuclei; right half of the medulla, seen from the surface of section; the parts that lie closer to this surface are deeper shaded. *Py*, pyramical tract; *Py.Kr*, decussation of pyramids; *O*, olivary body; *O.s*, superior olivary body; *V*, motor, *V'*, middle sensory, *V''*, inferior sensory nucleus of trigeminus; *VI*, nucleus of abducens; *G.f*, genu facialis; *VII*, nucleus facialis; *VIII*, posterior median acoustic nucleus; *IX*, glosso-pharyngeal nucleus; *X*, nucleus of vagus; *XI*, accessorius nucleus; *XII*, hypoglossal nucleus; *Kz*, nucleus of the funiculus gracilis; *RV*, trigeminus roots; those of the *RVI*, abducens and *RVII*, facialis.

3. A diagram of the columns of the spinal cord as seen in a transverse section. The left half shows the later subdivisions of the cord; the right half shows the older subdivisions.

waste; and (2) a *type of muscular atrophy* which differs from that of the so-called "progressive muscular atrophy" in that it affects entire groups of muscles from the onset, while, in the latter, separate bundles composing the muscles affected are destroyed, while others remain unchanged.

The reactions of the affected muscles to faradism and galvanism are similar to those of the acute form. It should also be mentioned that anæsthesia does not exist in this form of spinal paralysis, because the portions of the cord which are associated physiologically with sensation are not diseased.

AMYOTROPHIC LATERAL SCLEROSIS.

In connection with the two conditions which have been described, viz., lateral sclerosis and changes in the anterior horns, it may be well to consider an affection of the spinal cord where the two are combined. This has been named by Charcot, who first recognized the pathological changes which tended to produce it, "amyotrophic sclerosis."

The lesion is not confined, however, to the spinal cord, for it tends to extend through the medulla oblongata and even into the peduncle of the cerebrum; hence the nuclei of the hypoglossal, spinal accessory, and facial nerves are involved, as a rule, late in the disease. The changes in the anterior horns are apparently identical with those which cause progressive muscular atrophy. The morbid process seems to start first in the cervical enlargement of the spinal cord; for that reason the muscles of the upper extremity are first attacked.

Charcot has described the symptoms of this disease as divisible into three stages: (1) Those of the first stage being confined to the upper extremities; (2) those of the second being manifest in the muscles of the lower extremities; and (3) those of the third being the result of an extension of the morbid process to the medulla, thus causing "bulbar symptoms." While this is generally true, there are exceptional cases, in which the disease commences in the medulla and extends downward; and others, in which the lower limbs are first attacked and the disease gradually extends upward.

First stage. The duration usually covers a period which varies between four months and one year. The muscles of the upper limbs are affected early with tremors, and paresis or paralysis follows. The electric contractility is unimpaired. Fibrillary muscu-

lar twitchings are observed. A diffuse form of atrophy succeeds the paralysis, and rigidity and contractures of the muscles develop which create permanent deformities. The hand is frequently caused to assume an attitude of deformity in which the wrist and fingers are flexed. The muscles of the neck and jaw are sometimes thrown into a state of spasmodic rigidity; this tends, however, to disappear when the entire arm becomes atrophied. An interval of several months exists, as a rule, between the first and second stages; during which time the disease appears to remain stationary.

Second stage. The muscles of the lower limbs now become attacked with paralysis, accompanied with tonic and clonic spasms. The muscles gradually develop a state of contracture. The spinal reflexes are increased. After a considerable lapse of time, the rigidity of the muscles diminishes and gives place to atrophy and fibrillary twitchings.

The bladder and rectum are not affected, nor is there a tendency toward the development of bed-sores. During this stage the muscular atrophy of the upper limbs increases to a marked extent. The effects of this stage are similar to those of tetanoid hemiplegia which have been described (page 545).

Third stage. When the characteristic phenomena of paralysis of the "bulbar nuclei" of the medulla oblongata are superadded to the symptoms of the second stage, the disease has extended to the brain. In addition to all the clinical evidences of glosso-labio-laryngeal paralysis (page 520), serious disturbances of circulation and respiration from paralysis of the nuclei of the pneumogastric nerves are apt to occur before death terminates the sad spectacle. The disease usually proves fatal in from one to two years after the initial symptoms make their appearance.

PROGRESSIVE MUSCULAR ATROPHY.

A slow degeneration of the ganglion cells of the anterior horns of the spinal gray matter, probably independent of inflammatory changes, exists in this disease. It is one of the most chronic and incurable of all spinal affections and is comparatively common.

The close analogy which this disease bears in some instances to "poliomyelitis anterior" in the adult, as regards its symptoms, will help to explain the fact that such cases are sometimes described as a variety of progressive muscular atrophy.

This disease is essentially one of adult life, although the so-called "pseudo-hypertrophic paralysis" of children bears some resem-

blances to it. It affects males more frequently than females, and usually appears between thirty and fifty years of age.

Among the exciting causes may be mentioned: (1) A hereditary tendency; (2) excessive muscular efforts; (3) traumatic injuries of peripheral parts of the body; (4) lead poisoning; (5) certain blood conditions, such as rheumatism, measles, typhoid, etc.; (6) exposure to cold and dampness.

The chief clinical feature of this disease is a state of *muscular atrophy;* it is very gradual in its onset and unattended with any symptoms of paralysis. The patient may be unaware even of its existence until the muscles are markedly diseased. There are no febrile symptoms to mark its onset; the patient perceives a sense of muscular weakness only when the changes in the diseased part have impaired muscular contraction.

The *electrical reactions* of the muscles attacked by atrophy are normal in their formulæ, but are impaired in direct proportion to the number of fibres which are involved in the muscle tested. The so-called "degeneration reaction" is absent. When all the fibres of a muscle are destroyed all electrical phenomena are of course arrested.

In the early stages the *spinal reflexes* may be increased; this being the rule for many wasting diseases. When the muscles are very much diseased, however, they become proportionately diminished, and cease when all the fibres are destroyed.

In connection with the evidences of atrophy of the muscles, other symptoms are frequently observed. Among these may be prominently mentioned: (1) *Fibrillary twitchings*, which are more apparent in this disease perhaps than in any other, and are confined to the region of atrophic muscular changes; (2) *diminished temperature* in the affected parts, with a peculiar sensitiveness on the part of the patient to cold; (3) *pains* in the muscles and neighboring joints; (4) *deformities*, chiefly of the hand and forearm, as one of the results of shrinking of the muscles from between the bones, and the unantagonized action of unaffected muscles.

Progressive muscular atrophy commonly affects the upper extremities first; and homologous regions of both sides are, as a rule, successively attacked. A considerable lapse of time may exist before the lower extremities give evidence of similar changes.

In rare instances the disease commences in the muscles of the trunk and produces deformities of posture which are characteristic of a loss of power in the muscles of the back or abdomen. When the abdominal muscles are atrophied, the back is bent to an extent

which allows a vertical line dropped from the shoulders to pass through the sacrum; but, when the lumbar muscles are atrophied, a vertical line dropped from the shoulders falls behind the sacrum in the erect posture.

Symptoms of the so-called "bulbar paralysis," which indicate that the nuclei of the nerves which arise from the medulla oblongata are affected by an extension of the disease upward, are occasionally developed in progressive muscular atrophy. If so, the effects of such an extension upon the function of respiration may be a cause of death.

The diagnosis of this disease cannot well be confounded with any other spinal affection except the acute and sub-acute forms of poliomyelitis anterior (page 547). A lesion which affects the ulnar nerve might create a deformity which could be mistaken for a progressive muscular atrophy of one upper extremity, although there are points of difference which are peculiarly diagnostic. These will be given in a subsequent table.

Finally, it may be well to state that there are no trophic disturbances of the skin in progressive muscular atrophy, nor are the functions of the bladder, rectum, or sexual apparatus impaired.

PSEUDO-HYPERTROPHIC PARALYSIS.

A disease of childhood, which differs from progressive muscular atrophy: (1) In the fact that the muscles of the lower limbs are primarily affected with atrophic changes; (2) in that the small muscles of the hand are not affected; and (3) in the circumstance that some muscles become increased in size when involved. This has been named "pseudo-hypertrophic paralysis," because the increase in the size of the affected muscles is not a genuine hypertrophy but an increase in the interstitial fibrous tissue and fat of the muscles.

The question of the exact pathological changes which exist in this form of disease is not yet decided—observers of equal note having differed in their examinations of the nerve centres of patients so afflicted. Some authors hold that the disease is primarily one of the muscles; while others claim to have established the fact that the muscular changes are secondary to spinal lesions.

An *hereditary tendency* to the disease seems to be more clearly proven than the exact pathological processes which cause it. Boys are more frequently attacked than girls, and the changes in the muscles usually commence before the tenth year.

The symptoms of onset are very gradual and are characterized

PLATE XXIX.

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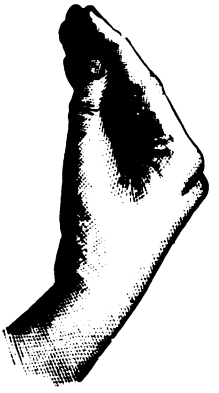

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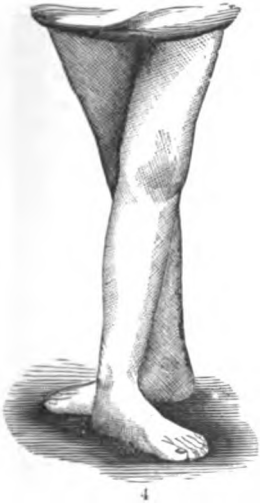

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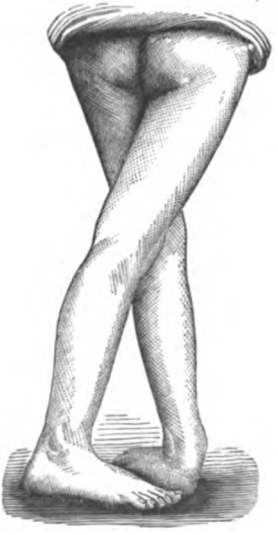

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1. Bell's paralysis. 2. 3. Deformities of hand in paralysis. 4. 5. Attitudes of limbs in crossed-legged progression. 6. Deformity of progressive muscular atrophy of entire upper extremity.

by a weakness of the legs and a clumsiness in walking which is exhibited by frequent stumbling and falls. . Gradually the patient assumes a characteristic attitude and gait. These will require a separate description.

The *attitude* is very peculiar. In the standing posture, the back is thrown beyond the proper position, so that a vertical line dropped from the shoulders frequently falls behind the sacrum; this antero-posterior curvature entirely disappears, however, when the patient is in the sitting posture. The feet are placed wide apart so as to increase the base of support. The heels are usually drawn upward by a contraction of the tendo-Achilles. In the effort to preserve the balance, the arms are held at the side with the hands extended, and the slightest touch may cause the patient to fall. Another remarkable feature of the disease is the difficulty which is experienced in rising from the recumbent, or even the sitting posture. The sufferer uses surrounding objects as a means of rising, drawing the body upward by the hands. When unable to reach such assistance the steps which are taken to rise are thus described by Gowers: "If laid, for example, on his back upon the floor and told to rise, he would first with great difficulty turn on his face; he would next get on his knees, his head being almost between his thighs; from this position he would gradually extend himself, so that he stands upon his feet and hands with all his limbs extended; finally he would extend the hip joint by grasping the thigh with the hand, and pushing up the body, as it were, by the arm." This movement of "climbing up the thighs," as it has been termed, is an indication of weakness in the muscles which straighten the knee and also those which extend the trunk upon the thigh—the extensors of the hip joint.

The *gait* of these patients is associated with an oscillation of the body from side to side, or a waddling movement. The advance made at each step is very small, and a difficulty seems to be experienced in flexing the thigh upon the abdomen.

The *muscles of the calf* exhibit early a firmness and increase in size which is not proportionate to their motor force—as that is far below normal. Soon they become excessively developed, as do also those of the buttock; while the other muscles of the leg commonly grow smaller from atrophic changes.

The *latissimus dorsi* and the lower part of the *pectoralis major* muscles exhibit marked wasting, in a very large percentage of cases. In some instances, all the striated muscular fibres of the body, including even the heart, may become affected.

The *electric reactions* of the muscles to Faradism are markedly diminished.

The *spinal reflexes* are diminished in the early stages, and, later on, are abolished. The bladder, rectum, and the sensory functions of the skin are not interfered with, as a rule.

CENTRAL MYELITIS.

Inflammation of the central gray matter of the spinal cord constitutes a systematic lesion (page 539). The other varieties of myelitis are properly included under the head of focal lesions of the cord, with the exception of poliomyelitis—a disease of the anterior horns, which has already been described.

This type of disease is rare, and may extend throughout the entire length of the spinal cord and involve both the kinesodic and æsthesodic tracts. By creating compression of the anterior horns it may cause the ganglion-cells of that region to become indirectly involved; or the inflammatory changes may reach this region of the gray matter directly by extension.

The symptomatology of this form of spinal disease, as might be inferred from the foregoing statements, is liable to be exceedingly complex. All the *disorders of sensibility* mentioned on page 543 may be encountered if the sensory tracts are affected; if the motor tracts are involved, *paralyses* of various forms and degrees (page 476) may develop with or without contracture; finally, if the anterior horns are attacked, more or less *atrophy* of the paralyzed muscles will be observed.

Since the disease is essentially a chronic one, years are afforded the physician to study the development of the various symptoms that arise as the inflammatory process gradually extends to tracts which are diametrically opposed in their functions. It should be remembered that in this (as in all inflammatory processes) a stage of *irritation* first exists, but is usually of short duration. Then *destructive changes* follow, causing a different set of nervous phenomena from those of the irritative stage. Finally, in the nervous system, these destructive changes are the exciting cause of a *secondary degeneration* of tracts of fibres within the spinal cord which are cut off by them from their association with trophic centres.

In the stage of irritation, disorders of sensibility may be evidenced by pain, numbness, formication, hyperæsthesia, etc. Later in the disease, more or less complete anæsthesia and delayed sensation may be developed, and the spinal reflexes may be decreased or abolished.

When the motor tracts of the cord become involved, irregularly distributed paralyses will be present; and contracture or atrophy of the paralyzed muscles, if present, will be valuable guides in determining the extension of the lesion to the lateral columns or the ganglion-cells of the anterior horns.

As the lesion extends upward into the cervical enlargement of the cord, the pulse becomes quickened and the pupils begin to show changes which result from irritation or destruction of the cilio-spinal centre.

The *bladder* and *rectum* are often paralyzed, because the centres which govern their physiological functions are situated within the spinal cord and may be destroyed by the inflammatory processes.

Bed-sores are not infrequently encountered, from destruction of the trophic centres of the skin.

The diagnosis of this disease cannot well be confounded with any of the systematic spinal lesions, as it is associated with a combination of both motor and sensory phenomena. Focal lesions of the cord resemble it in some respects; but they can usually be differentiated from it by the evidences of a progressive destruction of the superimposed segments of the cord. This will be better understood when the symptoms of focal lesions have been discussed.

SCLEROSIS OF THE POSTERIOR COLUMNS.

(Progressive Locomotor Ataxia—Tabes Dorsalis.)

This disease is an extremely chronic spinal affection which is characterized, when fully developed, by a difficulty in walking; not from loss of muscular power, but from an inability to properly coördinate the muscles. It is due to a lesion of the æsthesodic system (page 539), and is therefore associated, from the first, with disorders of the sensory functions of the cord (page 543), but not with those of motion.

This disease may be congenital or acquired. If acquired, it may follow traumatism of the spine, exposure to cold or dampness, sexual excesses, syphilis, and some acute blood-diseases; if congenital, it is commonly associated with a syphilitic diathesis.

The posterior column of older anatomists has been resolved by pathological investigation into two distinct columns—an external or Burdach's column, and an internal or Goll's column. The postero-median, or Goll's columns, are large and distinct in the cervical region of the cord, but become smaller and smaller as the lowest part of the cord is approached. They are not of as great

importance, from a pathological or clinical standpoint, as those of Burdach; because the symptoms of lesions confined exclusively to them are too uncertain and badly reported to be of much value.

It has been shown, however, that lesions of the postero-external, or Burdach's, columns commonly begin at the outermost portion near to the posterior horns of the spinal gray matter and tend to progress forward and inward. In advanced cases the sclerosis extends also into the columns of Goll; so that it can be inferred that the two are simultaneously affected when the late symptoms of locomotor ataxia are well developed.

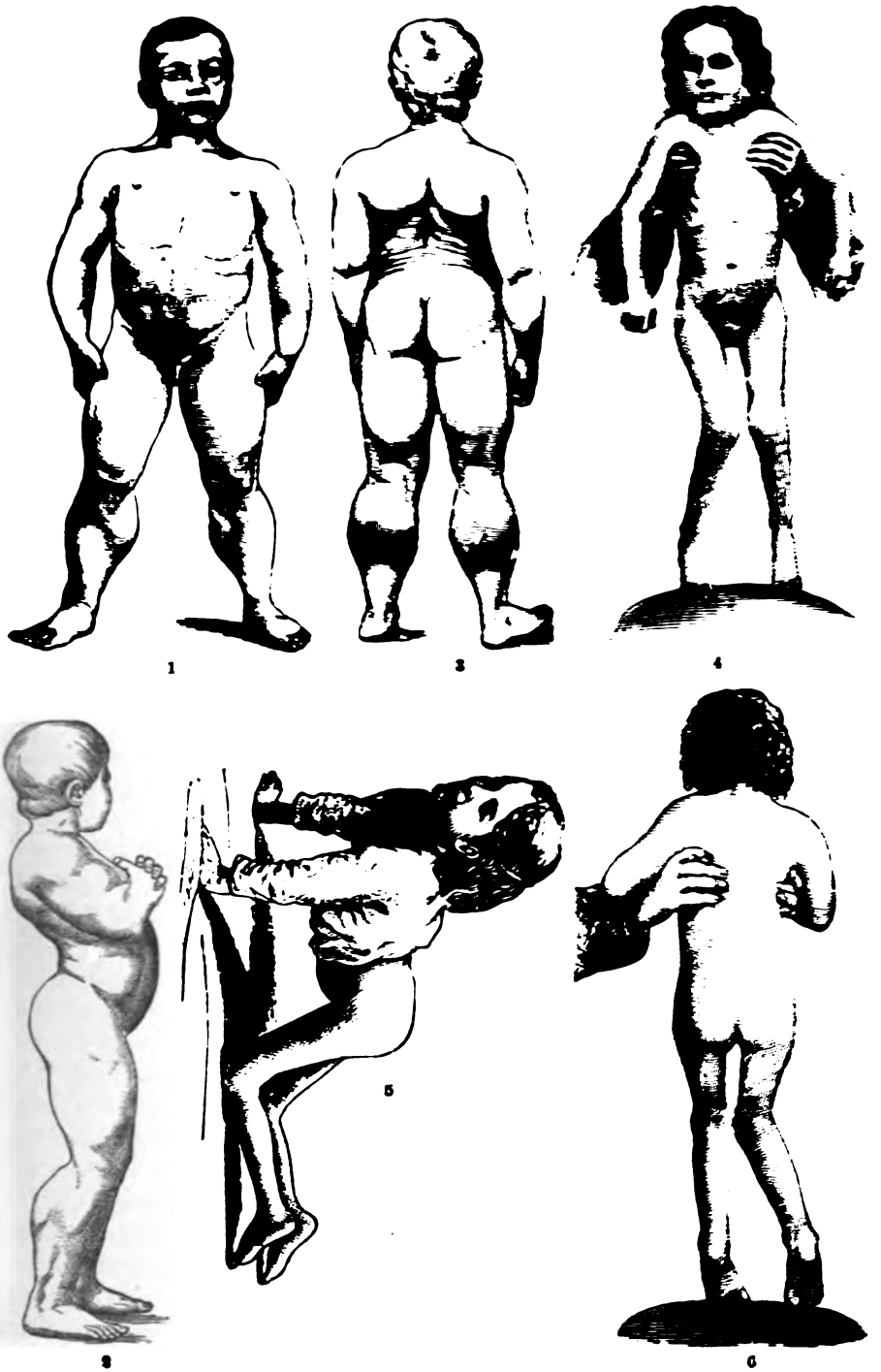
The symptoms of this chronic disease extend over so long a period of time (often ten to thirty years), that they have been commonly divided into three stages, viz., those of invasion, incoördination, and the stage of complications.

The STAGE OF INVASION is characterized by the following sensory phenomena: (1) pains of a peculiar character, which will be described later; (2) hyperæsthesia of the skin; (3) anæsthesia of the skin; and (4) retarded conduction of sensation. These are commonly observed in the lower extremities, because the sclerosis is confined as a rule to the dorsal and lumbar regions of the cord. If the disease has progressed to the cervical region, the upper extremities will be similarly affected, and, in addition, the pupils will be contracted and fail to respond to light (page 558).

In addition to the sensory phenomena described, the *spinal reflexes* (especially the patella reflex or knee-jerk) will be diminished or abolished.

The pains of this disease are to be differentiated from those of rheumatism and neuralgia. They are pathognomonic of the first and second stages and may persist even in the third. They are best described as "lightning pains," which are of a stabbing or boring character and extremely severe; and are paroxysmal and of momentary duration. Some patients compare them to an electric shock which gives a sensation as if a knife were run into the muscles or a joint. Unlike the pains of rheumatism, with which they are often confounded, they attack circumscribed areas between the joints, and seldom occur twice in the same spot. After the attack of pain has subsided, the skin over the seat of pain is extremely sensitive to the touch. They differ from the pains of neuralgia in that they do not follow the course of individual nerve-trunks; they are not associated with the so-called "puncta dolorosa" or points of sensitiveness to pressure along the course of the affected nerve, as is the case with neuralgia; they do not radiate

PLATE XXX.



1, 2, 3. Pseudo-hypertrophic paralysis. 4, 5, 6. Infantile paralysis.

in the superficial area of distribution of any special nerve-trunk; they are not commonly referred to the skin but to the deeper structures; finally, they are most frequently confined to the lower extremities or to the pelvic organs, chiefly the bladder and rectum.

These lightning pains are so severe and constant in some instances as to induce suicide; while, in less severe cases, the paroxysms are infrequent and easily controlled by anodynes. They may affect the stomach and be mistaken for those of dyspepsia. As the paroxysms of pain occur at intervals for months and often for years before the evidences of incoördination of movement appear, it is common for the specialist to meet with these patients after an incorrect diagnosis has resulted in a long-continued and ineffectual course of medication on the part of many medical advisers.

Hyperæsthesia of the skin (especially at the seat of pain after the paroxysm has passed away) is commonly met with in these cases. Like the pain, this increased sensitiveness is fugitive.

Anæsthesia of the skin to the sense of touch, pain, or temperature, is more or less completely developed as the disease progresses. These patients often experience, as a result of this anæsthesia, subjective feelings which are peculiar—as, for example, as if the feet were standing upon feathers or wool.

Delayed conduction of sensation. When the sclerosis of Burdach's column has progressed to an extent sufficient to interfere with, but not arrest, the conduction of sensation to the brain through the spinal cord, a symptom is produced which is of great clinical value, viz., the occurrence of a *perceptible interval of time* between the infliction of a wound (a pin thrust, for example,) or a simple tactile impulse and its perception by the patient. In making this test, it is well to have the patient close the eyes so as to obviate all danger of seeing the test applied. I have met with one case where the interval was ten seconds, and a very much longer interval has been recorded.

The STAGE OF INCOÖRDINATION OF MUSCULAR MOVEMENTS follows after a lapse of time which varies between the extreme limits of a few months and many years. These are first exhibited in the gait, because the lesion is confined primarily to the dorsal and lumbar regions of the cord in the great majority of cases. When the cervical region becomes involved, the upper extremities also exhibit a marked impairment of coördinated movements—as in the efforts to button and unbutton the clothing, to carry the hand with accuracy and rapidity to designated parts of the face or body when the eyes are closed, and in writing letters with continuous curves.

The *gait* of ataxic patients, although walking is extremely difficult

in some cases, is not that of paralysis; and the two should not be confounded with each other. In this disease, the motor power of any individual muscle is not impaired, nor do the limbs show any lack of development. It is only when some act is demanded which involves a coördination of muscular movement, or, in other words, where several muscles must be employed in some special order, that the difficulty becomes manifest. Too much emphasis cannot be laid upon this distinction between incoördination and a loss of muscular power. Among the early symptoms of incoördination which the patient experiences may be mentioned a difficulty in performing feats of locomotion when suddenly called for, as in hastily crossing a street, climbing a flight of steps, or washing the face with the eyes closed. Under such circumstances a sense of insecurity first dawns upon the patient and causes him to avoid such acts. Gradually he finds it necessary to stand with the feet apart to increase his base of support; to keep his eyes upon the ground when walking, so as to use the visual sense in directing his movements; and to employ canes to aid him in preserving his balance. Such patients have great difficulty from the first in placing the feet upon small objects, as in mounting into a saddle by means of the stirrup, climbing ladders, or in getting upon a chair to reach some object. As incoördination becomes more impaired, the patient walks slowly and with great deliberation. The feet are suddenly jerked outward; the heel strikes the ground before the sole of the foot, causing the peculiar "stamping gait"; and sometimes the movements of the legs are so unexpected that the patient falls to the ground.

When the *upper extremities* become similarly involved, the hand cannot be rapidly carried to designated portions of the body, as the nose, mouth, ear, shoulder, etc., when the patient is instructed to do so, with the usual accuracy, provided that the eyes are closed. The clothing is buttoned and unbuttoned with great difficulty. When asked to convey a glass of water to the lips, it is raised to the proper level, held there for an instant with the eyes fixed upon it, and then darted suddenly toward the mouth. The handwriting becomes markedly altered (especially when the eyes are closed), because all continuous curves are made with less ease than straight lines, if not too long. The pupils show the preternatural contraction which indicates that the cilio-spinal centre is implicated, and they also fail to properly respond to light, although they do move when vision is accommodated for a proper focus upon near objects within a distance of less than twenty feet.

In cases of extreme rarity, the incoördination affects the muscles of the spine.

The *spinal reflexes* are greatly altered in this disease, and form an important factor in the diagnosis. The knee-jerk is usually abolished at an early stage. Tickling the soles of the feet generally fails to elicit the so-called "plantar reflex."

In the LAST STAGE, that of COMPLICATIONS, the bladder, rectum, sexual organs, eye, bones, joints, skin, and stomach, are liable to give more or less constant evidence of effects of the spinal disease upon them.

The *bladder*, which, in the earliest stage, was affected by the lightning pains, hasty urination, and pain during the act, gradually exhibits the symptoms of paresis in slow micturition, dribbling, or incontinence, as the result of retention of residual urine, which overflows at last when the distended bladder cannot longer control its escape. This latter condition should not be allowed to go unrelieved from a neglect to insert a catheter. Finally, cystitis is often produced; and, in rare instances, anæsthesia of the urethra is observed.

The *rectum*, which, in the early stages, is frequently affected with stabbing pains and a painful sense of excessive distension, suffers a diminution in its reflex action later in the disease, which induces constipation. In the final stage, paralysis of the organ may be developed, and anæsthesia of its mucous lining is observed in exceptional instances.

The *sexual organs*, which, in the early stages, are often abnormally stimulated (the sexual desire being increased, but the act itself being more or less imperfect) are very much impaired in the advanced stages of the disease; the appetite as well as the power of erection being often completely abolished.

The *organ of vision* suffers late changes in locomotor ataxia. The peculiar alterations of the pupil, first described by Dr. Argyll Robertson, have been already mentioned (page 558). In addition, ptosis, strabismus, diplopia, and loss of color perception are not infrequently recorded as complications of this disease. Atrophy of the optic nerve may also be one of the results of the first stage. Some authorities lay great stress upon the diagnostic value of the ophthalmoscope as a means of detecting this early symptom of locomotor ataxia.

The *bones* and *joints* become disintegrated, as a result of this form of spinal disease, and deformities are thus produced. Charcot was the first to describe these conditions, and we owe to him much of our knowledge of the subject. The larger joints, such as the knee,

shoulder, and elbow, are the most liable to be affected. Females are most frequently attacked. The changes which occur are to be differentiated from those of chronic rheumatic arthritis by the following peculiarities: (1) That they are acute; (2) that they involve large joints and infrequently the hip, whereas the reverse is true of rheumatic arthritis; (3) that effusion into the affected joint is extensive, whereas the effusion is rare in rheumatic arthritis; (4) that dislocations are spontaneously produced, while they are extremely rare in rheumatic arthritis; (5) that the changes are usually painless, probably because analgesia is associated with them; (6) sometimes spontaneous fractures occur. The most plausible explanation of these bone changes, to my mind, is that advanced by Buzzard, viz., that they are due to changes within the medulla oblongata.

In connection with the changes in the bone and joints *gastric complications* sometimes occur. They are characterized by attacks of vomiting and severe gastralgia. They are more commonly observed in females than in males.

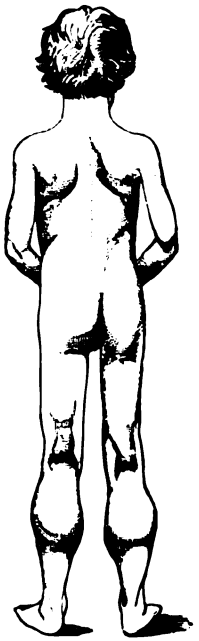
Finally, the *skin* may exhibit trophic disturbances in the form of herpetic eruptions and bed-sores.

"NON-SYSTEMATIC" OR "FOCAL LESIONS" OF THE SPINAL CORD.

By reference to the table on page 539, it will be seen that these lesions differ in their character from the systematic diseases which have been described. The clinical features which they present differ in each individual case, because they are modified by the situation of the lesion, in respect to the different columns of the cord as well as its height in the cord. The height of the lesion is determined partly by the region to which the so-called "cincture" or "girdle sensation" is referred; partly by the extent of the motor paralysis or sensory phenomena; again, by the superficial spinal reflexes which are found to be unimpaired; and, finally, by the history of the case, when the seat of the exciting cause can be well defined.

Focal lesions differ from the systematic or non-focal lesions in that they tend to spread laterally from column to column, often extending to the gray matter of the cord, and sometimes involving the entire structures of both lateral halves of the organ. At first such a lesion may be small and affect only a limited area; in such a case, the symptoms may be confined exclusively to either motor or sensory phenomena, depending upon the column which is af-

PLATE XXXI.



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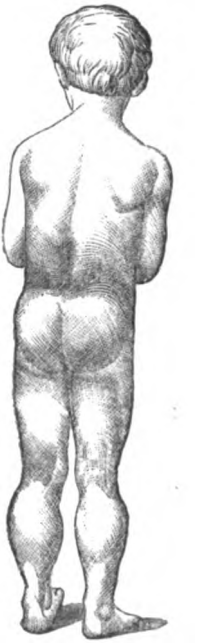

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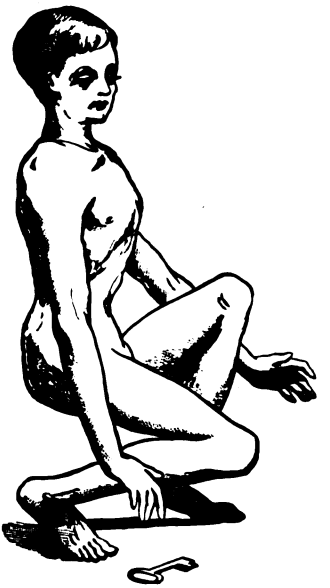

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1. Pseudo-hypertrophic paralysis confined exclusively to the calves of the legs. 2. Same condition affecting lower limbs, but not the trunk. 3. Atrophy of muscles and abnormal posture from spinal caries. 4. Attitude in stooping due to spinal caries.

tacked. As it spreads to adjacent columns the symptoms are modified, new ones being added which indicate the direction of its growth. Physiological and anatomical knowledge can alone aid in deciding as to the height of the lesion in the cord, or the portions which are destroyed by it, provided that the cause of the symptoms is not of a traumatic character.

Before we pass to the consideration of lesions confined to special segments of the cord, it may be well to refer again to a few general statements which have been made on page 540.

Focal lesions commonly give rise: (1) To paresis or paralysis of the extremities; (2) to numbness, formication, or anæsthesia; (3) to modifications of the superficial and deep spinal reflexes; (4) to paresis or paralysis of the bladder and rectum; and (5) to a tendency to bed-sores.

The spinal cord may be regarded, from a physiological standpoint, as composed of numerous segments which are superimposed; each of which is capable of an automatic action, and, in some of which, special centres which govern the action of the viscera and the calibre of blood-vessels are probably placed.

These segments of the cord are controlled, when necessary, by the ganglia of the brain which are of a higher order; but, if this controlling power is interrupted from any cause, as in spinal lesions for example, the spinal segments may still continue to act automatically. This is one of the explanations that have been advanced to explain the exaggeration of the spinal reflexes, which often exists when focal lesions of the spinal cord are present; as well as the fact that the bladder, rectum, sexual apparatus, and the skin are sometimes affected by such lesions and again are not.

The "SUPERFICIAL" or "SKIN REFLEXES," which have been previously referred to (page 541), are each performed by different segments of the cord. Thus stimulation of the skin of the sole of the foot by a scratch, prick, or touch with the nail, for example, induces a contraction of the foot-muscles (*plantar reflex*) through the lower part of the lumbar enlargement of the cord; the skin of the buttock calls into action the glutei muscles (*gluteal reflex*), through a segment which corresponds to the escape of the fourth or fifth lumbar nerve; the skin upon the inner aspect of the thigh causes the cremaster muscle to draw the corresponding testicle toward the external abdominal ring (*cremaster reflex*), by influencing the cord at the level of the first or second lumbar nerves; the skin upon the side of the abdomen creates reflex movements of the abdominal muscles (*abdominal reflex*), by affecting a segment of the

cord situated between the levels of the eighth and twelfth dorsal nerves; the skin upon the side of the chest creates a reflex response in the region of the epigastrium (*epigastric reflex*), which depends upon a spinal segment extending from the fourth to the seventh dorsal nerves; finally, the skin between the shoulder-blades causes the posterior axillary fold or the teres major muscle to contract (*scapular reflex*), by influencing the spinal segment between the levels of the fifth cervical and third dorsal nerves.

By means of these reflexes, we are enabled to test the various spinal segments from the neck to the terminal extremity of the cord. Should any be found to be absent, it should be remembered: (1) that the reflex excitability of the cord varies with individuals and is always greater in youth than old age; (2) that the plantar, cremasteric, abdominal, and epigastric reflexes are variable in health, but are more constant than the scapular; (3) that cerebral lesions may impair them on the side of the hemiplegia, for reasons not as yet well understood; and (4) that systematic lesions of Burdach's or Goll's columns tend to diminish or abolish them.

The "DEEP" or "TENDON REFLEXES" are also of great value as a means of determining the condition of excitability of different segments of the cord. The ones now commonly employed are called the "*foot-clonus*"; the "*knee-jerk*" or "*patella reflex*"; the "*peroneal reflex*"; and the "*tendo-Achilles reflex*." The method of obtaining these reflexes in the most satisfactory manner will be described separately. It is important, however, to remember one fact in connection with them before deciding as to their clinical significance, viz., that the *reflexes should be tested upon both sides and compared with each other*, because any perceptible differences between the two sides is a positive indication of some pathological lesion of the cord.

The *knee-jerk* has for years been recognized and employed by Charcot in diagnosis, although it was first systematically investigated as a clinical symptom by Westphal and Erb. Gowers remarks in a late work: "It is not a little curious that this knee-jerk, which for generations has amused school-boys, should have become an important clinical symptom."

To properly test this reflex movement of the limb, the muscles of the quadriceps extensor tendon must be put upon the stretch to a moderate degree, and the leg be unrestricted in its ability to respond. The common method employed is to have the patient cross the leg over the knee and allow it to hang passively at an angle which is nearly ninety degrees. Perhaps a still better way is that

employed by Gowers, viz., to allow it to hang over the forearm of the physician when his hand is placed upon the opposite knee of the patient, because, in this way the jerk is often elicited in stout people when it otherwise fails. The space between the patella and the tibia is then struck with a percussion hammer or the side of the physician's hand upon the bare skin with sufficient force to slightly increase the state of muscular tension which has resulted from flexion of the leg. This will cause a reflex contraction of the quadriceps extensor muscle and the foot will be jerked upward without the volition of the patient as a factor in the movement.

The *ankle-jerk.* If the muscles of the tendo Achilles be put upon the stretch by flexion of the foot, a blow upon that tendon will cause a similar extension of the foot.

The *foot-clonus.* When the excitability of the cord is excessive, if the foot be firmly flexed and held so by the pressure of the hand against the sole, a series of rhythmical reflex movements of extension follows, which vary between six and ten per second. They can be traced upon a revolving drum by attaching a pencil to the foot, as easily as a sphygmographic tracing is made. This clonus is more apparent when the knee is firmly extended than when flexed.

The *peroneal reflex.* The tendons of the peroneal muscles pass to the bones of the foot at the outer side of the ankle. A blow made upon them when the foot is bent inward to produce a moderate degree of tension of these muscles, will elicit a reflex movement, as in the case of the patella tendon.

The "*front-tap contraction.*" Gowers has described a reflex test for increased spinal irritability that he considers particularly delicate. It consists in flexing the foot with the hand upon the sole, the knee being extended, and applying the blow to the muscles on the anterior aspect of the leg. It is followed by a reflex contraction of the muscles of the tendo Achilles which are not directly affected by the blow.

Although the deep reflexes are commonly tested only in the lower extremities, the same phenomena may be elicited in the triceps or biceps muscle of the arm as in those of the thigh and calf, if subjected to the necessary position to insure tension of the muscles before the tap is given over the tendon.

Before we pass to the consideration of focal lesions of the spinal cord in detail, let us attempt to summarize the more important clinical deductions pertaining to these deep spinal reflexes.

1. A *persistent foot-clonus* never occurs in health. It indicates that the lateral columns of the cord are probably involved by some

spinal lesion. In supposed hysterical affections, this symptom will often decide the question of the existence of organic disease. It must not be mistaken for the involuntary foot-clonus which sometimes occurs when an unnatural posture is long maintained, even in health. It is usually associated with exaggeration of all the other deep reflexes.

2. All *reflex tests become abolished* when the muscles are separated from their connection with the spinal cord; hence severing of a nerve, posterior sclerosis, compression of the spinal nerve-roots, destruction of the gray matter of the cord, poisons, etc., are often associated with their complete abolition.

3. Disease of the *lateral columns* usually *decreases the skin reflexes*, especially those of the trunk. This is particularly true of the so-called descending degeneration of these columns, which follows cerebral lesions.

4. When marked *incoördination of movements* is present and the *deep reflexes* are not abolished, it indicates that sclerosis of the lateral columns probably coexists with similar changes in Burdach's columns.

5. *Spasm* is a marked symptom in many diseases of the spinal cord. It commonly indicates an excessive action of the reflex motor centres. It is particularly common as an acute symptom in spinal meningitis. In chronic organic diseases of the cord, it assumes the form of *contracture of muscles*, especially if the lateral columns are attacked; this condition becomes transformed into that of genuine spasm when the slightest forms of peripheral impressions are experienced, as in delicately manipulating the muscles, for example.

In a previous table, the more common varieties of focal lesions of the spinal cord have been enumerated (page 539). To consider each of these in detail would exceed the limits of a single chapter, and it is not necessary to do so, because all produce their symptoms in the same way, viz., either by compressing some portion of the cord or primarily destroying one or more of its columns (see diagram) or some portion of its gray matter. All focal lesions are therefore liable to present combinations of both motor and sensory phenomena, and it is this peculiarity which distinguishes them during life from the so-called "systematic lesions."

The *height of focal lesions* of the cord and *their extent* in a transverse direction may be ascertained with some accuracy during life by a knowledge of the distribution of the spinal nerves, the point where each is given off from the cord, and the functions of the

different columns of the cord itself. Such cases are of special interest to the anatomist.

If the *motor tracts* of the cord are involved by the lesion, all the nerves which spring from the cord below the lesion will give evidence of paralysis; should the lesion be unilateral, only the motor nerves of the corresponding side below the lesion will be affected, but, if bilateral, those of both sides will be paralyzed.

The *symptoms of incoördination* of muscular movements are developed on the same side as the lesion of the cord; hence, when the lesion is bilateral, both sides of the body will be affected in exact proportion to the amount of damage done to the columns of Burdach.

Sensory phenomena are produced on the side opposite to the spinal lesion, because the sensory fibres decussate before passing upward to the brain. Should a lateral lesion of the cord involve all of the corresponding lateral and posterior columns, motor paralysis and incoördination would exist on the corresponding side of the body below the seat of the destructive process, and all sensory manifestations would be confined to the opposite side of the body. There are rare exceptions to this rule, which are clinically observed, where the motor and sensory phenomena are upon the same side of the body; these are probably to be explained in one of two ways—either that the spinal nerve-roots are involved by the lesion, or that the sensory nerve-fibres are impaired before the decussation occurs in the cord, because we know that the crossing is not always immediate.

In focal lesions, as well as the systematic, the *signs of atrophy* in the muscles of the limbs points to a destructive process in the ganglion-cells of the anterior horns of the spinal gray matter.

Rigidity and *spasm* of the muscles, after they have developed paralysis, indicates a descending degeneration of the lateral columns, as a rule.

Alterations in the *bodily temperature* and *sweating* of the limbs, when they occur as a result of spinal lesions, are to be attributed to a disturbance in the so-called "vaso-motor" centres of the organ.

The *nutrition of the bones, joints and skin* is liable to be affected by focal lesions. These have been described in connection with sclerosis of the posterior columns of the cord (page 559).

The *sexual functions*, and also the physiological acts of *defecation* and *micturition*, depend upon the integrity of centres in the lumbar enlargement of the cord. They may be seriously impaired by focal lesions of that region.

Let us now consider the effects of focal lesions of the cord at different levels. These may be made of use in diagnosis. I take the liberty of quoting from my late work upon the Anatomy of the Nervous System, selections from those pages that cover the more essential points which bear upon this subject.

It is often possible and of great practical importance to the diagnostician to tell in what region of the cord the lesion is situated, and to estimate the height to which it has progressed. Of course, this is much easier in focal lesions than in the systematic, since the different columns of the cord can then simultaneously furnish symptoms which can be compared, and thus aid in the diagnosis. In the table, to which I some time ago directed attention, you will perceive that the focal lesions include traumatisms (of all forms); compression of the cord (chiefly by bone and tumors); transverse sclerosis of the cord; transverse softening of the cord; hæmorrhage into the substance of the cord; and, finally, certain tumors which involve the cord itself. There are many other causes which might excite some local lesion, but these are the ones which will most frequently come under the notice of the practitioner.

A few anatomical points are suggested in this connection as of value in spinal diagnosis: (1) The hypo-glossal and the pneumogastric nerves arise from the medulla, which lies above the level of the axis; (2) the phrenic arises on a level with the spine of the axis; (3) the brachial plexus and the ulnar nerve are connected with the cord in the region of the neck (third to sixth cervical spines); (4) the cilio-spinal centre is probably situated between the fifth cervical and the second dorsal vertebræ; (5) the lumbar enlargement of the cord gives off the crural and sciatic nerves at different points, and the space between the eleventh dorsal and the second lumbar spines includes the point of origin of both; (6) the spinal cord ends at the level of the second lumbar spine, although the nerves continue to escape from the spinal canal much below that point.

We have already studied the effects of systematic lesions, both of the kinesodic and æsthesodic systems, and have noticed how perfectly the physiology of the spinal cord is confirmed by lesions affecting the anterior or posterior portions of the cord separately. We are now to investigate those lesions which, by extending in a transverse direction, are liable to be accompanied by symptoms referable to both the sensory and motor portions of the cord. Of course, the symptoms will be modified by the extent of the lesion in a transverse direction, so that they may be mostly sensory or, again, chiefly motor; but the presence of both sensory and motor symp-

toms is *strongly diagnostic of focal lesions*, irrespective of a predominance of either, and is never produced by any systematic lesion of the cord, with the one exception of central myelitis.

We will start with a general statement in our study of focal lesions, as follows: focal lesions usually give rise to *paralysis of motion*, to an *alteration* in the *reflex excitability* of the cord (usually an increase), and to more or less *anæsthesia*, *numbness*, and *pain*; the *bladder* and *rectum* are *often paralyzed*, and a *tendency to bed-sores* is frequently produced. The first two of these effects, and also the last, are due to alteration in the kinesodic system; the remaining ones are the result of some disturbance to the æsthesodic system.

In studying focal lesions situated in different regions of the spinal cord, we must adopt some method if we expect to grasp the fine distinctions which can be drawn between the results of lesions of the upper cervical region, the cervical enlargement, the mid-dorsal region, the region just above the lumbar enlargement, and, finally, the lumbar enlargement itself.

Focal Lesions in the Upper Cervical Region.

In this condition, hemiplegia will be produced if one lateral half of the cord be alone affected; while paraplegia will be present if the lesion extends transversely to both lateral halves of the cord. The hemiplegia or paraplegia will be complete below the head, and the entire body may be rendered anæsthetic. Since the *phrenic nerve* arises at this point, the act of respiration will be interfered with, creating dyspnœa and hiccough; but respiration will not be arrested, since the pneumogastric nerves continue to excite it, and the auxiliary muscles of respiration can expand the chest without the action of the diaphragm. Should the lesion be a surgical one (as it usually is), the *respiratory centre* of the medulla may be affected, and death take place from asphyxia; but I do not think such a result can be explained as a simple effect of paralysis of the phrenic nerves alone. The presence of the *cilio-spinal centre* in the lower cervical region may cause the pupils to show an irregularity, and the face and neck may manifest a marked increase of temperature. The pulse may be rendered variable, from irritation of or pressure upon the *accelerator centre* of the heart.

Now, as I have before said, this type of lesion is almost always a surgical one, comprising pressure from fracture, dislocation, caries, tumors of the vertebræ, etc., and these cases seldom live long enough for us to study the effects of such a lesion with much detail. In those rare instances where the lesion is non-traumatic and

slowly developed, the effects of irritation have been shown in a hiccough (probably due to irritation of the phrenic nerve); acceleration of the pulse (from irritation of the acceleratory centre of the heart); and dyspnœa (from some interference with the phrenic nerve or the nucleus of the pneumogastric nerve in the medulla). The paralysis first appears in such cases as a paretic condition of the arms, then of the chest, and, finally, of the lower limbs.

Focal Lesions of the Cervical Enlargement.

This type of lesion differs in its effects, if developed suddenly or gradually; and also when situated in the upper or the lower part of the enlargement. If the lesion be so situated as to create *only irritation* of the cilio-spinal centre, or the acceleratory centre for the heart (both of which are in that vicinity), the effects will differ from those due to actual pressure upon, or destruction of, those centres. In the first instance, the pupils will usually be dilated and the face pale, while the heart will be accelerated; in the latter, the pupils will generally be contracted, the face and neck flushed, and the pulse retarded. The effects will also differ if the lesion affects both lateral halves of the cord or only one.

Wherever the lesion may be situated within the cervical enlargement, the arms and legs will gradually become paralyzed; the arms and hands usually becoming first numb and paretic, and the lower limbs exhibiting, for some time, only a sense of weakness and evidences of an increased reflex excitability. A sense of constriction around the chest (the so-called "cincture feeling") is generally present, the seat of which varies with that of the exciting lesion.

When the lesion is situated at the *upper part* of the enlargement, the motor and sensory symptoms will be manifested in the lower extremities, the trunk, and in nearly all the regions of the upper extremities. The constricting band around the thorax is referred to the *level of the clavicles*, and dyspnœa is often excessive.

The brachial plexus is associated with the upper part of the cervical enlargement, and the ulnar nerve with the lower part; hence the paralysis of the arms in this case would naturally be manifested in almost all of the regions of the upper extremity, and also in those parts supplied by the brachial plexus above the clavicle.

If the lesion be situated in the *lower part* of the cervical enlargement, the symptoms exhibited will include a loss of Faradic reaction of those muscles which are supplied by the *ulnar nerve* (rather than those of the arm and the extensors of the forearm); and atrophy of these muscles will often be developed, chiefly in the flexors of

the wrist and the small muscles of the hand. The same sense of constriction (cincture feeling), as experienced in most spinal lesions of a local character, will exist, but it will be referred to the upper part of the chest. A paralytic condition of the muscles of the trunk (the intercostals, triangularis sterni, and the accessory muscles of respiration), as well as of the abdominal muscles, will be detected in severe cases, rendering both inspiration and expiration embarrassed, and thus adding to the danger to life. The lower limbs may exhibit evidences of numbness, anæsthesia, paresis, or complete paralysis, depending upon the extent of the lesion and the destruction done to the tissues of the cord. A condition of paralysis may also exist in the upper extremity.

In surgical injuries to the upper portion of the cord, a peculiarity is often noticed in the *temperature of the body*, which is sometimes greatly elevated. This clinical feature may be associated with a marked retardation of the action of the heart (apparently confirming the situation of an *acceleratory centre* for that organ in the spinal cord).

Focal Lesions of the Mid-dorsal region of the Spinal Cord.

In the early stages of this condition, the lower limbs become paretic; and a condition of increased reflex excitability is manifested by a rigidity and stiffness of the impaired muscles whenever the patient attempts to stand or walk. As the disease progresses, the muscles become paralyzed and contractured* (probably on account of changes of a secondary character in the lateral columns of the cord). In some cases, the reflex movements assume the type of spasms, so as to exhibit both tonic and clonic contractions. It was this symptom which suggested to Brown-Séquard the name of "spinal epilepsy," since it occurs when the patient is exposed to the slightest peripheral irritation, and often when in the recumbent posture.† The sense of constriction around the body is referred to the region of the navel, or that of the lower ribs, or possibly as high as the axilla, since it may be taken as a relative guide to the highest limit of the lesion. A peculiarity exists in this condition as regards the bladder and the rectum; although they may be paralyzed, they are often enabled by the aid of reflex action to

* A term used in contradistinction to the word "contracted," to designate a *permanent* shortening rather than a temporary response to a motor impulse.

† The presence of urine in the bladder or of fæces in the rectum may often create these spasms.

expel their contents, thus apparently having regained their function. In the early stages, the urine and fæces may be too hastily expelled for the comfort of the patient, often compelling the performance of either act before a proper place can be reached; but, in the advanced stages, the urine is retained to such an extent as to cause an "overflow," which is often mistaken for an actual incontinence, since a constant dribbling is present. This symptom is always an indication for the regular use of a catheter. The sexual function seems to be often unimpaired, as coition is frequently possible. It is seldom that the paralyzed muscles exhibit a tendency to atrophy, and the electrical reaction of the affected parts is either normal or exaggerated. The chief seat of weakness is usually detected first in the feet, and the paralysis gradually involves the entire lower limbs.

Focal Lesions Above the Lumbar Enlargement of the Spinal Cord.

In this situation, a focal lesion of the cord produces about the same sensory and motor symptoms as those described in connection with a lesion of the mid-dorsal region, with the exception that the *reflex spasms*, present in the paralyzed muscles, are perhaps somewhat less violent than when the lesion is higher up the cord. These tonic and clonic spasms are, however, sufficiently well marked to constitute a prominent symptom,* and they indicate an increased reflex excitability of the gray matter of the cord below the seat of the lesion. An ingenious explanation of this increased reflex has been advanced by Professor Seguin of this city, which seems to merit respectful consideration. I quote from a late paper of his upon affections of the spinal cord, as follows:

"The classic theory of the physiology of contracture in hemiplegia is that it is due to the secondary degeneration—*i. e.*, actively caused by the lesion of the postero-lateral column. Seven years ago (see "Archives of Scientific and Practical Medicine," vol. i. p. 106, 1873) I rejected this hypothesis, and suggested a different one, which I have since elaborated and taught in my clinical lectures. This hypothesis, which I intend shortly to publish in detail, is briefly that the spasm is due, not to direct irritation from the sclerosed (?) tissue in the postero-lateral column, but to the cutting off of the cerebral influence by the primary lesion, and the consequent preponderance of the proper or automatic spinal action—an

* These reflex spasms have been called by Brown-Séquard "spinal epilepsy."

action which is mainly reflex. This theory explains the phenomena observed in cases of primary spinal diseases with descending degeneration, and can be reconciled with results of experiments on animals (increased reflex power of spinal cord after a section high up, Brown-Séquard; inhibitory power of the encephalon on the spinal cord, Setchenow)."

The urinary and rectal organs are affected by lesions of this segment of the cord in about the same way as in lesions of the dorsal region. Coition is often possible, and erections are normally frequent. The rectum is paralyzed, as a rule, and constipation is usually present on that account. Micturition becomes slow and interrupted, as the bladder grows paretic, and retention and overflow are produced later on in the disease.

The paralysis of the extremities is first noticed in the feet, which have long before exhibited a sense of weakness and easy fatigue. Numbness and anæsthesia usually accompany the motor paralysis, and extend as high as the groin or the waist. The sense of a constricting band around the body is present here, as in lesion of other localities, and is referred to the waist, below the level of the umbilicus, or at the level of the hips.

Focal Lesions of the Lumbar Enlargement.

The lower portion of the lumbar enlargement gives origin to the *sciatic nerve;* hence, it is reasonable to expect that a lesion situated in the lower part of this enlargement would be manifested by symptoms of an incomplete paraplegia, in which the muscles supplied by the sciatic nerves would be the most affected. Now, this fact seems to be confirmed by clinical experience; since the feet, legs, posterior aspect of the thighs, and the region of the nates are chiefly paralyzed when the lesion is so situated. The bladder is unaffected, but the sphincter ani muscle is often rendered paretic, or it may be entirely paralyzed. The portions of the limbs which are to become the seat of paralysis usually exhibit a *sense of numbness* before the effects of the lesion are fully developed; and, in case the posterior columns of the cord be involved, complete anæsthesia may also exist in the parts supplied with motor power by the sciatic nerve. The condition of the paralyzed muscles, as to their electrical reactions, and the presence or absence of the evidences of increased reflex excitability, will depend greatly upon how much damage has been done to the gray matter of the lumbar enlargement. If the gray matter be so destroyed as to impair its function, the

reflex movements will be absent; and, if the trophic function of the cord be affected by changes in the ganglion cells of the gray matter, the paralyzed muscles will undergo atrophy. The sense of constriction, or "band feeling," will usually be referred, in this lesion, either to the ankle, leg, or thigh.

Focal Lesions Confined to the Lateral Half of the Spinal Cord.

In discussing the focal lesions of the cord, we have described the clinical points which are afforded by destruction, to a greater or less extent, of the substance of the cord in both of its lateral halves; hence, the motor and sensory symptoms have been usually referred to both sides of the body. It was necessary to thus describe them, since focal lesions, unless traumatic, are seldom confined to one lateral half of the cord; but, in some cases which may be presented to your notice, where a tumor, a fractured vertebra, a hæmorrhage, a severe contusion, or some other localized lesion exists, the injury done to the spinal cord may be confined exclusively to one lateral half, resulting in one of two named conditions, viz., "spinal hemiplegia" and "hemi-paraplegia."

Any lesion of a *lateral half* of the spinal cord must produce anæsthesia in the *opposite side of the body*, since all the sensory nerves *decussate* and enter the gray matter of the cord, which probably serves as a conducting medium for sensory impressions; while the *motor symptoms* produced by the same lesion must be confined to the *same side of the body as the lesion*, as no decussation probably occurs in the spinal cord (these fibres decussating only in the medulla oblongata).

Lateral lesions, as well as those which affect the entire cord, are modified, as regards their symptomatology, by the *height of the lesion* in the cord; since the motor nerves, and the special centres which are situated in the cord itself, will only be affected when they lie below the seat of the lesion or are directly involved in the destructive process.

When the focal lesion is placed high up in the substance of the spinal cord, the motor paralysis affects *one side only* of the body (provided the lesion is confined to a lateral half), and the term "spinal hemiplegia" is applied to this form of paralysis in contradistinction to a hemiplegia of cerebral origin. If the spinal lesion be situated in the dorsal region and be confined to the lateral half of the cord, a motor paralysis of *one half* of the same side of the

body *below the seat of the lesion* is developed, a condition to which the term "hemi-paraplegia" is commonly applied. In closing the clinical aspects of lesions of the spinal cord, it will be necessary, therefore, for us to consider the essential features of these two remaining conditions.

Spinal Hemiplegia.

In order to produce a typical case of this condition, it is necessary to have a lateral focal lesion of the cord in its uppermost part (in or above the cervical enlargement of the cord). If we suppose, then, that such a lesion be present, let us see what we might reasonably expect, on purely physiological grounds, would be the result. We can then examine the clinical records of such cases, and either confirm our deductions or gain some additional information. Such a lesion, in the first place, would shut off all motor impulses sent out from the brain to parts below the lesion, on the same side as the lesion, since the decussation of the motor fibres has already taken place in the medulla; hence motor paralysis should, theoretically, occur in the arm and leg of the side of the body corresponding to the seat of the exciting lesion, and the trunk should also be paralyzed upon that side. This we find, clinically, to be true,* with the exception that the *intercostal nerves* often retain their motor power, when the nerves of the arm and leg are no longer capable of carrying motor impulses. In the second place, we should expect to find that the *sensation* of the side of the body opposite to the seat of the lesion would be destroyed or greatly impaired, since the sensory nerves decussate throughout the entire length of the cord. This we also find confirmed by clinical facts; and so perfect is this anæsthesia that the line can often be traced to the mesial line of the body exactly, and upward to the limit of the exciting lesion. In the third place, the situation of the *cilio-spinal centre* in the cervical region of the cord would naturally suggest some effects upon the pupil, as well as upon the circulation and temperature of the face, neck, and ear of the same side. This is also confirmed by clinical experience, as the pupil does not respond to light, (although it still acts in the accommodation of vision for near objects) and the skin of the regions named becomes red and raised in temperature. Finally, the presence of *vaso-motor centres*

* The researches of Brown-Séquard, as early as 1849, and his published memoirs (1863–'65 and 1868, 1869), have probably done more to clear up this field and to place it upon a positive foundation than those of any other observer.

in the cord might occasion a rise in temperature in the paralyzed muscles; and, strangely confirmatory of this fact, we often find the temperature of the paralyzed side of the body higher than that of the anæsthetic side.

In some exceptional cases, the face, arm, and trunk are alone paralyzed, the legs seeming to escape, and often giving evidence of reflex spasm (perhaps most commonly on the anæsthetic side). This must be explained as the result of incomplete destruction of the lateral half of the cord.

Hemi-Paraplegia.

This condition is the result of some focal lesion of the spinal cord in the *dorsal region*, which involves only its lateral half. The results of such a lesion differ but little from those of one causing spinal hemiplegia, as regards the motor and sensory symptoms, excepting that the situation of the exciting cause is below the cervical enlargement, where the nerves to the upper extremity are given off, and where the cilio-spinal centre is situated. For that reason the muscles of the upper extremity are not paralyzed, nor are the effects upon the pupil and the skin of the face, ear, and neck (mentioned as present in spinal hemiplegia) produced. The muscles below the seat of the lesion are paralyzed on the side of the body corresponding to the exciting cause, and the skin is sometimes rendered hyperæsthesic upon that side;* while the integument of the side opposite to the lesion is deprived of sensibility. The bladder and rectum may be paralyzed in some instances. The sense of constriction, or "band feeling," will vary with the seat of disease in the spinal cord. The amount of *reflex irritability* and the presence or absence of *muscular atrophy* in the parts paralyzed will depend upon the depth of the lesion in the spinal cord and the changes which have been produced in the gray matter. The same increase of temperature in the paralyzed limb, which was mentioned as occurring in spinal hemiplegia, may also be present in this variety of paralysis.

Should the side affected with anæsthesia give any evidence of motor paralysis or muscular weakness, or should symptoms of anæsthesia appear upon the side where the motor paralysis is present, you may regard either phenomenon as conclusive evidence that the exciting lesion is progressing, and that the opposite lateral half of the cord is being involved to a greater or less extent.

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* This is probably due to some irritation of the gray matter of the cord.

UNILATERAL SCLEROSIS OF THE LATERAL COLUMN.	UNILATERAL SCLEROSIS FOLLOWING A CEREBRAL LESION.
FACE.	
Is not affected.	May be paralyzed.
TONGUE.	
Is not affected.	May be paralyzed.
UPPER EXTREMITY.	
Less paralyzed and *rigid* than the lower, except in *amyotrophic lateral* sclerosis.	*More paralyzed* and *rigid* than the lower.
SPINAL REFLEXES.	
The superficial and deep reflexes are exaggerated.	The superficial reflexes are diminished or abolished. The deep reflexes are exaggerated.
SENSORY PHENOMENA.	
There are no abnormal sensory phenomena if the "crossed pyramidal tract" is alone involved.	Slight anæsthesia is not uncommon.
If anæsthesia should exist it will be on the side *opposite* to the motor paralysis.	Anæsthesia, when present, is on the *same side* as the motor paralysis.
ONSET.	
May be sudden or gradual, as the cause may be acute or chronic.	Is usually sudden.
If gradual, the rigidity and the motor paralysis are simultaneously developed.	The rigidity follows the motor paralysis.
CEREBRAL SYMPTOMS.	
Are absent.	Are usually to be detected.

SYMPTOMS IN COMMON.

Both may be associated with hemiplegia.
" " " " " muscular rigidity.
" " " " " exaggerated deep spinal reflexes.

PRIMARY LATERAL SCLEROSIS.	SECONDARY LATERAL SCLEROSIS (*dependent upon a transverse focal lesion of the cord*).
MUSCULAR RIGIDITY.	
Is developed with the paralysis. Is more marked than the motor weakness.	Follows the paralysis. Is less marked than the paralysis in the early stages.
MUSCULAR ATROPHY.	
Is absent.	May be developed at the upper level of the lesion.
ONSET.	
Is slow and gradual.	Is comparatively rapid.
SENSORY PHENOMENA.	
Are absent.	Pains of a shooting character and disturbances of sensation (page 543) exist.
PELVIC ORGANS.	
Are normal.	Are usually affected.
SKIN.	
Is normal.	Trophic disturbances (page 540) occur in some cases.

SYMPTOMS IN COMMON.

Both are associated with motor weakness or paralysis.
" " " " muscular rigidity.
" " " " muscular spasms.
" " " " increase of the superficial and deep spinal reflexes.

POLIOMYELITIS ANTERIOR (SUB-ACUTE VARIETY).	POLIOMYELITIS ANTERIOR (ACUTE VARIETY).
AGE AFFECTED.	
From 30 to 50 years of age.	Is a rare affection in adults.
ONSET.	
The onset is very gradual.	The onset is sudden.
FEVER.	
The fever is slight or absent.	Febrile symptoms are well-marked.
BRAIN SYMPTOMS.	
There are no convulsions or other cerebral symptoms.	Cerebral symptoms are not uncommon.
PARALYSIS.	
The paralysis develops gradually from below upward. It reaches its maximum slowly.	The paralysis reaches its maximum suddenly, and tends to improve from the commencement.
RECOVERY.	
The recovery may be complete.	If recovery follows, some paralysis and atrophy remain.
FATALITY.	
Is not fatal, as a rule; but when so, it produces death by a gradual extension to the medulla oblongata.	Is seldom fatal; but when so, death occurs at the initial stage.

SYMPTOMS IN COMMON.

Both may be associated with fever before the paralysis.
" " " " " atrophy of muscles.

POLIOMYELITIS ANTERIOR. (Sub-acute Variety.)	DEGENERATION OF THE GANGLION-CELLS OF THE ANTERIOR HORNS. (Progressive Muscular Atrophy.)
Part First Attacked.	
The muscles of the lower extremity are primarily attacked, as a rule.	The upper extremity is affected first, as a rule; the hands and deltoid muscles particularly.
Paralysis.	
Paralysis precedes the atrophy.	No paralysis precedes the atrophy.
Atrophic Changes.	
Whole muscles or groups of muscles atrophy at once.	The muscles atrophy by separate fibres or bundles of fibres, but never equally throughout.
Electrical Reactions.	
The formulæ of electrical reaction of the affected muscles are those of degeneration.	The electrical reaction of "muscular degeneration" is absent.
Spinal Reflexes.	
The spinal reflexes are abolished, as a rule.	The spinal reflexes are retained in direct proportion to the amount of atrophy present. They are abolished only when the whole muscle is destroyed.
Progress of Disease.	
The muscles may completely regain their normal condition.	The affected muscles never improve in their power of contraction, but steadily grow worse.

POLIOMYELITIS ANTERIOR (*continued*).	DEGENERATION OF THE GANGLION-CELLS OF THE ANTERIOR HORNS (*continued*).

FATALITY.

The disease is not generally a fatal one.	The disease is often fatal.

SYMPTOMS IN COMMON.

Both may be associated with deformity from atrophic changes.
" " " " " wasting of muscles.
" " " " " loss of muscular power.
" " " " " abolition of spinal reflexes.
" " " " " peculiar electrical reactions.

PROGRESSIVE MUSCULAR ATROPHY.	LESION OF THE ULNAR NERVE.
PARALYSIS.	
No paralysis occurs, but motor weakness follows the atrophy of the muscles.	Paralysis develops suddenly if the lesion is traumatic. Atrophy follows later on.
DEFORMITY.	
All the fingers are equally flexed, because the interossei muscles are all atrophied.	The ring and little fingers are more affected than the others, because the median nerve supplies two of the lumbricales.
SENSIBILITY.	
There is no anæsthesia.	Both sides of the little, and the ulnar side of the ring fingers, are deprived of sensibility.
TROPHIC DISTURBANCES.	
The skin exhibits no trophic disturbances.	The skin supplied by the ulnar nerve may exhibit trophic disturbances.
HISTORY.	
The history of an exciting cause is generally obscure or absent	Some traumatism of the nerve, or a tumor or cicatrix in the course of the nerve, are the more common causes.

SYMPTOMS IN COMMON.

Both may be associated with deformity of the hand.
" " " " " atrophy of the muscles of the hand.
" " " " " more or less loss of power in the hand.

TETANOID PARAPLEGIA.	LOCOMOTOR ATAXIA.
PAIN.	
Is absent.	Is a pathognomonic symptom. (See page 556.)
SENSORY PHENOMENA.	
Are absent.	*Anæsthesia, numbness, formication,* and *delayed sensation* are developed.
PARALYSIS.	
Is developed before the rigidity of the muscles occurs. It may be incomplete.	Is absent.
INCOÖRDINATION.	
Is absent.	Is almost a pathognomonic symptom. (See page 558.)
MUSCULAR RIGIDITY.	
Develops in the paralyzed limbs.	Is not developed.
GAIT.	
The legs are stiff.	The legs are not stiff.
The foot seems fastened to the ground and scrapes over it in walking.	The feet are jerked about in an aimless and uncertain manner.
The knees often become interlocked, in attempts at walking.	The knees are far apart, as are also the feet, when standing or walking.
The foot crosses the other in making an advanced step.	The foot strikes the ground upon the heel—giving the "stamping" character to the gait.
SPINAL REFLEXES.	
Are markedly exaggerated—especially the deep reflexes. (See page 562.)	Are decreased or abolished.
PELVIC ORGANS.	
Are healthy.	Are impaired, from a decrease or destruction of the vesical and rectal reflexes.

LOCOMOTOR ATAXIA.	GENERAL PARALYSIS OF THE INSANE.
DURATION.	
May last for many years.	Runs its course in a few years.
CEREBRAL SYMPTOMS.	
Are developed late, if at all, in the form of imbecility and impaired memory.	Are the most prominent symptoms of the period of onset.
They are often absent.	Are often of a violent type.
PARALYSIS.	
Motor paralysis is never developed.	Motor paralysis develops early.
INCOÖRDINATION.	
Is pathognomonic (page 558).	Is absent.
PAIN.	
Is of a *peculiar character* (page 556) and is a prominent symptom from the onset.	May be absent. It does not usually exhibit any diagnostic features.
PELVIC ORGANS.	
Are often affected. Slow and labored micturition is frequently present.	Are rarely affected.
SEXUAL DESIRE.	
Is usually decreased.	Is commonly increased, at the onset.
FACE.	
Seldom affected.	Is altered in its expression from the onset.
TONGUE.	
Is affected late, if at all.	Is affected early, causing a thick and indistinct articulation. Fibrillary tremors may be observed in the tongue.

PSEUDO-HYPERTROPHIC PARALYSIS.	PROGRESSIVE MUSCULAR ATROPHY.
AGE ATTACKED.	
Children under 10 years of age.	Is chiefly confined to adults.
SPINAL COLUMN.	
Saddle-back curve, seen only when standing or walking.	The back is not deformed unless the muscles of that region become atrophied.
LEGS.	
Enfeebled early in disease, as shown by stumbling, and falling.	Usually affected late in the disease.
The *heels* are elevated (talipes equinus).	The heels are not elevated.
The *calves* and *buttocks* become greatly enlarged, as the disease progresses.	The muscles do not undergo hypertrophy.
The *feet* are placed wide apart when standing is attempted.	No special attitude is assumed.
ARMS AND HANDS.	
Are not affected with paralysis or hypertrophy, until late in the disease, if at all.	Are affected early.
They are held extended by the sides, when the standing posture is attempted, in order to aid in balancing the body.	The hands become greatly deformed; chiefly as the result of atrophy of the interossei and thenar muscles.
The *latissimus dorsi* and the lower part of the *pectoralis major* muscle show atrophic changes.	The deltoid region is affected early.
	Homologous muscles of the two sides are successively attacked.
GAIT.	
Walking is rendered impossible, as the disease progresses.	The power of walking is seldom if ever entirely lost.
The patient waddles, and the steps are short and uncertain.	

PSEUDO-HYPERTROPHIC PARALYSIS (*continued*).	PROGRESSIVE MUSCULAR ATROPHY (*continued*).
Fibrillary Twitchings.	
Are usually absent.	Are particularly well-marked in the affected muscles.
Temperature.	
The temperature is often raised above the normal point over the parts attacked.	Is lowered over affected regions.
Cerebral Symptoms.	
Are seldom developed.	Paralysis of the bulbar nuclei (Duchenne's disease) develops late in some cases.

SYMPTOMS IN COMMON.

Both may be associated with spinal curvature.
" " " " " abnormality of gait.
" " " " " fibrillary twitchings.
" " " " " abnormalities of temperature.
" " " " " loss of muscular power.

PARALYSIS AGITANS.	CEREBRO-SPINAL SCLEROSIS.
TREMORS.	
Voluntary efforts to control the tremors do not lessen or increase them.	Voluntary efforts increase the tremors.
	The tremors subside with repose.
FACE.	
The facial muscles are not affected.	The facial muscles may exhibit tremors or actual paralysis.
GAIT.	
The patient has to run to preserve the balance.	The gait is simply a staggering one.
SPEECH.	
The speech is slow, and impaired by the muscular movements.	The speech is characterized by the effects consequent upon paralysis.
AGE.	
Old subjects are commonly attacked.	The disease commonly occurs during middle life.

SYMPTOMS IN COMMON.

Both are associated with tremors.
" " " " an abnormal gait.
Both may be associated with an impairment of speech.

ORGANIC PARAPLEGIA.	FUNCTIONAL PARAPLEGIA.
Method of Onset.	
The onset may be rapid, especially if due to meningeal or spinal hemorrhage, spinal congestion, or acute myelitis; it may also be gradual when due to other causes.	The onset is gradual, except in the hysterical variety.
Spasm and Pain.	
Spasms or pain in the affected limbs are more or less marked, as a rule.	Spasms or pain are seldom present.
Cincture Feeling.	
The cincture feeling (girdle-pain) is commonly developed in focal lesions.	No sense of constriction in any special part is complained of by the patient.
Anæsthesia.	
Anæsthesia, more or less complete, is often observed.	Partial anæsthesia may exist, but it is never complete.
Delayed Sensation.	
Delayed conduction of sensation (page 557) may exist.	Sensation is never delayed.
Sphincters.	
The sphincters may be involved, especially in focal lesions above the lumbar enlargement.	The bladder is occasionally affected; but in the hysterical variety only.
Spinal Reflexes.	
The spinal reflexes (page 561) are not alike on both sides of the body.	The spinal reflexes are alike on both sides.

SYMPTOMS IN COMMON.

Both may be associated with sudden or gradual onset.
" " " " " partial anæsthesia.
" " " " " motor paralysis.
" " " " " paralysis of the bladder.
" " " " " alteration in the spinal reflexes.

MYELITIS.	SPINAL MENINGITIS.
PAIN IN BACK.	
Pain in the back is not a very prominent or constant symptom. In some cases it may be severe.	Pain in the back is a marked and constant symptom.
It is increased by *firm pressure, percussion,* or by passing a *sponge wet with hot or cold water* over the spine at the seat of the lesion.	It is increased by *movements of the spine.*
ANÆSTHESIA.	
Anæsthesia appears early. It may be complete.	Anæsthesia occurs late in the disease and is only partial.
HYPERÆSTHESIA.	
Hyperæsthesia is often absent.	Hyperæsthesia is a prominent symptom.
PAIN IN LIMBS.	
Shooting pains in the limbs are a marked symptom.	Shooting pains are not necessarily present.
PARALYSIS.	
Paralysis of motion appears early in the disease.	Motor paralysis appears late in the disease. It may be absent.
CRAMPS AND SPASMS.	
Cramps and spasms of the limbs are less prominent than in meningitis.	Cramps, spasms, and rigidity of the limbs, and a stiffness in the muscles of the back are very marked.
SPHINCTERS.	
The sphincters are often paralyzed.	The sphincters are not paralyzed.
URINE.	
The urine is often ammoniacal.	The urine is not ammoniacal.

MYELITIS (*continued*).	SPINAL MENINGITIS (*continued*).
SKIN.	
The skin often exhibits atrophic disturbances.	The skin is rarely affected.
FEVER.	
Febrile symptoms are sometimes absent, although they may be present.	Febrile symptoms are generally well-marked.

SYMPTOMS IN COMMON.

Both may be associated with pain in the back.
" " " " shooting pains in the limbs.
" " " " anæsthesia and hyperæsthesia.
" " " " paralysis of motion.
" " " " cramps and muscular spasms.
" " " " febrile symptoms.
" " " " trophic disturbances of the skin.
" " " " cincture feeling.

SPINAL MENINGITIS. (Acute Variety.)	TETANUS.
History.	
The exciting cause may be obscure.	There is the history or presence of a wound, except in the idiopathic variety.
Sensory Phenomena.	
Pressure upon, or irritation of the cord or the spinal nerve-roots may cause anæsthesia or hyperæsthesia.	Sensory derangements are infrequent.
Pain in the back and shooting pains in the limbs are well-marked symptoms.	Pain may exist in the region of the wound, or during the tonic convulsions.
Muscular Spasm.	
Tonic spasms are often present, but are not very severe.	Tonic spasms are characteristic, and are extremely severe. They may affect almost all the muscles of the body.
Face.	
Trismus, and the expression of face called "risus sardonicus" are not developed.	Trismus and the "risus sardonicus" occur early in the attack, and are pathognomonic.
Spinal Reflexes.	
The spinal reflexes are generally increased to a slight extent.	A very marked exaggeration of the spinal reflexes occurs.
Cerebral Symptoms.	
Cerebral complications are not uncommon.	The mind remains perfectly clear.

SYMPTOMS IN COMMON.

Both are associated with pain in the back and limbs.
" " " " tonic spasms of the muscles.
" " " " increase of the spinal reflexes.

REFLEX PARAPLEGIA.	MYELITIS.
PARALYSIS.	
The paralysis affects the lower limbs, alone, as a rule.	The paralysis is influenced by the height of the lesion in the cord.
It does not progress upward.	It gradually progresses upward.
It is usually not complete.	It is complete in many cases.
BLADDER AND RECTUM.	
The bladder and rectum are not markedly affected.	The bladder and rectum are often paralyzed.
SPASMODIC TWITCHINGS.	
Spasms of the muscles are uncommon.	Spasms of the muscles are always present to a greater or less degree.
GIRDLE SENSATION.	
The "cincture feeling" is absent.	The "cincture feeling" is present, and is a guide to the upper limit of the lesion in the cord.
SENSORY PHENOMENA.	
Sensory phenomena (page 543) are usually absent.	Anæsthesia, numbness, formication, etc., are frequent.
SPINAL TESTS.	
No pain in the spine is elicited by pressure, heat, or cold.	The application of pressure, heat and cold usually produces some abnormal sensations of pain or heat.
URINE.	
Urine is acid.	Urine is alkaline, as a rule.

REFLEX PARAPLEGIA (*continued*).	MYELITIS (*continued*).
ATROPHY OF MUSCLES.	
No atrophic changes in muscles are developed.	The muscles frequently atrophy.
RECOVERY.	
Recovery often occurs.	Recovery is rare.

SYMPTOMS IN COMMON.

Both may be associated with motor paralysis.
" " " " altered reflexes.
" " " " spasms of the muscles.
" " " " affections of the bladder and rectum.
" " " " gastric derangements.

GENERAL PARALYSIS.	SYPHILITIC GENERAL PARALYSIS.
CEREBRAL SYMPTOMS.	
Exalted notions, and delusions of various kinds may exist.	Are rare or absent.
SPEECH.	
Is impaired, and rendered tremuluos and jerky.	Is thick and indistinct.
TREMORS.	
Are present in the hands and lips, as a rule.	Are generally absent.
PUPILS.	
Are generally contracted.	Often normal.
MORAL INSTINCTS.	
Often perverted.	Not affected.
FIBRILLARY TWITCHINGS.	
Are often a marked symptom.	Are absent, as a rule.
CRANIAL NERVES.	
Are not usually attacked.	Are often paralyzed; chiefly the motor oculi and the optic nerves.
HEADACHE.	
Is not marked.	Usually *increased at night.* Is liable to affect *one lateral half* of the head.
APHASIA.	
Is liable to be of long duration, when it occurs.	Is usually *transient*, if it occurs. Is probably due to vascular changes.
RECOVERY.	
Is commonly fatal.	Improves under specific treatment.

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INDEX.

A.

Abdomen, Aneurism of, 29.
Contusions of the, 335.
Injuries of the, 335.
Wounds of the, 335.
Abdominal Aneurism, 25, 27, 28.
Cavity, Surgical Diseases of the, 335.
Diseases, painful, 28.
Reflex, 561.
Tumors, 27.
Wall, abscess of, 400, 402.
Abrasion, Balanitic, 332.
Abscess, 398.
Acute, 399.
Acute, Articular, 52.
Chronic, 399.
Cold, 399.
Mammary, Acute, 431.
Chronic, 431.
Iliac, 400.
of Abdominal Wall, 400, 402.
of Antrum, 129, 428.
of Bone, 99, 102, 110, 123.
cause of, 102.
symptoms of, 103.
over a vessel, 26.
Pelvic, 447.
Perineal, 320.
Periosteal, 99.
Prostatic, 307.
Psoas, 29, 78, 349, 368, 401.
Secondary, simultaneous appearance of, 16.
Urethral, 317.
Acceleratory centre of heart, 561.
Adenoma, 406.
Aesthesodic system, Lesions of, 540.
of Spinal cord, 539.
Amblyopia, 483, 486, 496.
from cerebral causes, 488.
Amyotrophic lateral sclerosis, 539, 549, 550.
Anaesthesia, coexisting with motor paralysis, 505.
general, 479, 488.
local, 479.
of nasal or buccal cavities, 490.
Anchylosis, 49.
Bony, 70.
Fibrous, 70.
of Joints, 60, 105.
varieties of, 60.
Aneurism, 3, 7, 23, 24, 26, 35, 36, 128, 411.
Abdominal, 25, 27, 28.
Anatomical locations of, 8.
Arterio-venous, 8.
by Anastomosis (Nævus), 7.
Causes of, 9.
Cerebral, 464.
Cirsoid, 7, 34, 38, 39.
Classification of, 8.
classified on basis of location, 8.
Common, 8.
Cystogenic, 8.
Diffuse, 7, 8.
differential Diagnosis, 14.
Dissecting, 7, 8, 464,
Encysted, 8.
External, 8.
Aneurism, False, 7, 8.
Fusiform, 7, 8.
Hernial, 7.
internal, 8.
in general, 22.
Miliary, 464.
Osteo-, 113.
of Abdomen, 29.
of Arch of Aorta, 4.
of Bone, 32.
of Innominate Artery, 40.
Table of, 7.
Thoracic, 8, 30, 31.
ascending portion, 12.
symptoms of, 12,
Traumatic, 9.
True, 7, 8.
Varicose, 7, 8, 41, 42.
Various types of, 22.
Aneurismal Diathesis, 9.
Tumor, effects of pressure upon, 11.
growth of, 10.
in general, symptoms of, 10.
situation of, 10.
Varix, 7, 36.
Angioma, 406.
Ankle-jerk, 563.
Anosmia, 479, 486.
double, 488.
Anthrax, 397.
Antrum, Abscess of, 129, 428.
Cystic Tumor of, 130.
Malignant Tumor of, 130.
Solid Tumors of, 129, 428.
Tumors of the, 406.
Anus, Condylomata of the, 353.
Fissure of the, 357.
Ulcer of the, 339.
Aorta, Aneurism of Arch of the, 40.
relaxed pulsation of, 25.
Aphasia, 483, 484.
Amnesic, 483, 484.
Ataxic, 483, 484.
A guide to Trephining, 505.
symptoms of, 520.
with hemianopsia, 489.
Apoplexy, 461.
cerebral, 494.
with injury, 198.
Arachnitis, 461, 468, 469.
Arterial Coats, Diseases of, 3, 4.
Fatty Degeneration of, 3.
Weakening of, 9.
Arteries, Diseases of, 3.
Fatty Degeneration of, 9, 22.
Occlusion of, 15.
from Emboli, 3.
from Foreign Bodies, 3.
from Pressure, 3.
from Thrombi, 3.
Arterio-venous Aneurism, 8.
Artery, Innominate, Aneurism of, 40.
Arthritis, 56, 103, 123.
Acute, 57, 66, 68, 69, 122.
Chronic, 57.
Chronic Osteo-, 58.
general symptoms of, 57.
local symptoms of, 58.

Arthritis, Rheumatic, 57.
acute, 66.
chronic, 58.
Rheumatic, chronic, of Temporo-Maxillary articulation, 159.
Rheumatic, chronic, with contusion, 236.
Syphilitic, 57.
Ascites, 445.
Ataxia, 498.
cerebral, 487.
Atheroma, 3, 4, 461, 464, 465.
Athetosis, 498.
Atrophic spinal paralysis, 539.
Atrophy of Brain, 473.
of Prostate Gland, 308.
Auditory Nerve, lesions of, 492.
Vertigo, symptoms of, 534.
Axilla, Glands of, Cancer of, 420.
Axillary Glands, Tubercular Disease of, 420.
Tumors of, 411.

B.

Balanitic Abrasion, 332.
Balanitis, 325.
Barton's Fracture, 226.
Bell's Palsy, symptoms of, 513.
Paralysis, 491.
Biliary Colic, 28.
Bladder, Atony of the, 305.
Bar at neck of, 288.
Conditions of the, not necessarily associated with structural changes in the Organ, 297.
Deficiency of, 287.
Diseases associated with structural changes within the, 288.
Diseases of the, 287.
varieties of, 287.
Extroversion of, 287.
Gangrene of, 288.
Hernia of, 288.
Hypertrophy of the walls, 288.
Inflammatory condition of, 288.
Inversion of the, 288.
Malformations of the, 287.
Multiplicity of, 287.
Paralysis of the, 305.
Rupture of the, 288, 301.
symptoms of, 289.
Stone in the, 291, 300, 304.
Etiology of, 291.
Physical signs of, 294.
Rational symptoms of, 293.
Suppuration of Vesical Walls, 288.
Tumors of the, 288.
Blood-vessels, diseases of, 3.
Bone, Abscess of, 99, 102, 110, 123.
cause of, 102.
symptoms of, 103.
Aneurism of, 32.
Atrophy of, 99, 105.
Cancer of, 32, 100, 112, 126, 300.
Caries of, 99, 109.
symptoms of, 110.
Colloid Tumor of, 100.
complications in locomotor ataxia, 559, 560.
Cystic Tumor of, 100, 106
Cysts of, 125.
Death of, 111.
Diseases of, 99.
special types, 129.
Encephaloid Tumor of, 100.
Entozoa, of, 118.
Exostoses of, 125.
Fibrous Tumors of, 100, 118.
Fibro-cystic Tumors of, 100.
Fractures of, of the leg in the vicinity of the knee, 241.
Gangrene of, 99, 111.
gradual changes in, or abnormal deviations from healthy type of structure, 99.
Hydatids of, 118.
Hypertrophy of, 99, 104.
Inflammation of the coverings of, 99.
Bone, Inflammatory diseases of, 99.
Internal Malleolus, Fracture of, 244.
Malignant Cysts of, 100.
Tumors of, 100, 114.
Necrosis of, 99.
changes in, 111.
Non-malignant Tumors, 99.
Patella, Fracture of, 242.
Pulsatile Tumors of, 34, 100, 113, 126, 128.
Rachitic condition of, 99, 103.
Scirrhous Tumor of, 120.
Spontaneous Fracture of, 99.
Tumors of, 99.
Ulceration of, 99.
Bowel, condition of, in hernia, 346.
Brain, Abnormal conditions of, (table), 461.
Abscess of, 467.
symptoms of, 522.
Absence of, 461, 463.
Acoustic area of, 497.
Apoplexy of, 494.
Atrophy of, 461, 471, 473.
Congenital Abnormalities of, 461.
Malformations of, 462.
Cortex of, destructive lesions of, 508.
irritative lesions of, 508.
lesions of, 493.
Degeneration of, 461.
Destructive lesions of, effects of, 477.
Diseased conditions of vessels of, 461.
Diseases of, 461.
general symptoms of, 462.
Dropsy of, 426.
Embolism of, 466.
Gustatory region of, 497.
Inflammation of coverings of, 466.
Inflammatory conditions of, 461.
Internal Capsule of, 476, 480, 505.
lesions of, 494.
Irritative lesions of, effects of, 477.
lesions of base of, 490.
Mental area of, 499.
Microcephalous, 463.
Motor area of, 493, 494, 499.
Motor tract of, 487, 504.
Multiple Sclerosis of, symptoms of, 532.
New growths of, 461.
Occipital lobes of, lesions of, 494.
Olfactory centre of, 496, 497.
Parasites of, 474.
Sclerosis of, 461, 471, 473.
Sensory tract of, 487.
Softening of, 461, 471, 494.
symptoms of, 522, 527.
Suppuration of, 467.
Syphilis of, 474.
Tactile centre of, 497.
Temporal lobes of, lesions of, 494.
Thrombosis of, 465.
Tumors of, 408, 461, 474, 495.
symptoms of, 527.
Vessels of, 494.
Visual area of, 499.
Breast, Cysts of the, 432.
Glandular Tumor of, 432, 433.
Innocent Tumors of the, 434.
Scirrhous Cancer of the, 434.
Tumors of the, 430.
varieties of, 430.
Broca's centre, 484, 493.
Bruit, 11.
Bubo, 342, 348, 363.
Bubonocele, 342, 364.
Bursæ, 407.

C.

Calculi, Prostatic, 309.
Urethral, 318.
Vesicle, consistency and appearance of, 293.
Etiology of, 291.
Shape of, 293.
Canal, Femoral, Lipoma of, 369, 371.
Tumors in region of, 412.
Inguinal, Tumors in region of, 412.

Cancer, 405, 412.
Acute, 417.
Alveolar, 419.
"Chimney-sweep," 418.
Chronic, 417, 418.
"Clay-pipe," 418.
Colloid, 419.
symptoms of, 414.
Encephaloid, 35, 417.
Symptoms of, 413.
Epithelial, 418.
Epithelioma, symptoms of, 414.
Fibrous, 417, 418.
Gelatinous, 419.
Medullary, 417.
of Axillary Glands, 420.
of Bladder, 300.
of Bone, 32, 100, 112, 126.
of Omentum, 421.
of Prostate Gland, 308.
of Rectum, 339, 356.
of Testicle, with fungus, 267.
Scirrhous, 417, 418.
of the Breast, 434.
of organs, 419,
symptoms of, 413.
varieties of, 413.
Carbuncle, 397.
Carcinoma, 406, 412.
Cardiac Hypertrophy, 9.
Caries, 120.
Central Myelitis, 554, 555.
Cerebellum, absence of, 463.
Cerebral absence, Symptoms of, 522.
Cortex, lesions of, 493.
Symptoms of, 508.
Embolism, 466.
Symptoms of, 518.
Hemianæsthesia, 488.
Hemiplegia, diagnosis of, 530.
Motor paralysis, symptoms of, 515.
Sclerosis, symptoms of, 532.
Softening, 471.
symptoms of, 523, 527.
Thrombosis, symptoms of, 518.
Tumors, symptoms of, 527.
Cerebritis, 461.
Cerebrum, absence of, 463.
Basal ganglia of, 500, 504.
Motor tract of, 504.
Thrombosis of, 465.
Vessels of, Spontaneous perforation of, 464, 465.
Chancre, 326, 330.
Chancroid, 326, 330.
Chancroidal ulcers, 313.
Cheyne-Stokes respiration, 492, 505.
Choked disc, 475, 488, 496, 505.
Choreiform movements, 498.
with paralysis, 480.
Cilio-Spinal centre, 566, 568.
"Cincture, feeling," axioms of, 540.
Clavicle, Fractures of the, 209.
Fracture of, inside of Coracoid Process, 211.
Fracture of, outside of the Coracoid Process near the Conoid Ligament, 211.
Fracture of, symptoms of, 209.
Column, Direct cerebellar, 541.
of Türck, 541, 544.
Complete paralysis, 479.
Conjugate Deviation of the Eyes, 480, 497.
Contracture of paralyzed muscles, 570, 571.
Convulsions coexisting with motor paralysis, 505.
Cord, Spinal. See Spinal Cord.
Corpora Striata, atrophy of, 463.
Corpus Striatum, Caudate Nucleus of, 504.
Effects of destruction of, 505,
Functions of, 504, 505.
Lenticular Nucleus of, 504.
lesions of, 504.
Cortical paralysis, 476.
Cranio-tabes, 107.
Cranium, Exostoses of, 116, 132, 424.
Tumors of the, 422.
Cellulitis, Pelvic, 451.
Cephalæmatoma, 427.
Cerebral Hernia, 340, 341, 345.
Cirsocele, 277.
Cloacæ, 112.
Chordee, 328.
Colic, Biliary, 28.
Intestinal, 28.
Renal, 28.
Colles' fracture, 226.
Comedones, 407.
Compression, Cerebral, 200.
Concussion, Cerebral, 199, 200.
Contusions of the Abdomen, 335.
over the Trochanter of the Femur, 173.
Cord, Hydrocele of the, 285.
Corpora Cavernosa, chronic circumscribed inflammation of, 328.
Diseases of the, 327.
Inflammation of the, 327.
Condylomata, 353.
Cowperitis, 317.
Cremaster reflex, 561.
Crossed paralysis, 478, 479, 486, 487, 488, 489, 491.
Symptoms of, 509, 510, 511, 512.
Types of, 478.
Cryptorchidism, 261.
Cyclocephalic deformity, 461, 463.
Cystic disease of Prostate, 308.
Sarcoma, 258.
Cystitis, Acute, 288, 304.
Chronic, 288, 306.
Cystocele, 341, 345.
Cysts, Congenital, 407.
Extravasation, 407.
Exudative, 407.
Fibro-uterine, 442.
Mucous, 407.
of Antrum, 130.
of the Breast, 432.
of Broad Ligament, 407.
of Kidney, 407.
of Liver, 407.
of Testes, 266, 283.
Ovarian, 442.
compound, 407.
unilocular, 448.
Renal, 448.
retention, 407.
Sebaceous, 407.
Serous, of Neck, 407.

D.

Deformities, Urethral, 317.
Degeneration, fatty, of arteries, 22.
of vessels, 43.
of Ganglion cells of anterior horns, symptoms of, 579, 580, 581.
of spinal cord, 539.
Delayed Sensation, 480.
Descending Sclerosis due to cerebral lesion, 576.
Diaphragmatic Hernia, 374.
Diathesis, Aneurismal, 9.
Direct Cerebellar Column, 545.
Pyramidal tract, 544.
Disease, Cystic, of Prostate, 308.
Diseases affecting Calibre of Vessels, 3, 7.
of Arterial Coats, 4.
of Brain, 461.
of Bladder, 287.
of Bladder, associated with structural changes, 288.
of Bladder, varieties of, 287.
of Bone, 99.
special types, 129.
of Corpora Cavernosa, 327.
of Crest of Ilium, 84.
of Glans Penis, 325.
of Intestine, 337.
of Joints, 49.
classification of, 49.
in general, 50, 64.

Diseases of Male Genitals, 257.
varieties of, 257.
of Penis, 325.
of Prepuce, 326.
of Prostate Gland, 307.
of Rectum, 338.
of Spinal Cord, 539.
of Testicle, 257.
Table for the diagnosis of, 270.
Varieties of, with enlargement, 257.
Varieties of, without enlargement, 261.
of Tissues, 379.
of Trochanter of Femur, 81.
of Tunica Vaginalis and Spermatic Cord, 273.
of Urethra, 313.
of Urethra, affecting structure of its coats, 313.
Sacro-Iliac, 75, 79.
Special, of Joints, 70.
Surgical, of Abdominal Cavity, 335.
Tubercular, of Axillary Glands, 490.
Dislocations, 135, 253.
causes of, 135.
classification of varieties, 135.
congenital, of Jaw, 138.
general symptoms of, 135.
special, 136.
at Ankle Joint, 181, 185, 186.
of Astragalus, backward, 182.
externally, 184.
forward, 182.
internally, 184.
upward, 183.
of Carpus, 162, 163, 164, 165.
of Clavicle, 148.
varieties of, 148.
of Elbow Joint, 149.
Table of, 159.
of Femur, "Dorsum Ilii," 169.
"Pubic," 171, 172, 240.
"Sciatic notch," 169, 170, 239.
"Thyroid," 171.
of Forearm, both bones, backward, 151, 153, 154, 156, 221.
both bones, forward, 154.
of Hip-joint, 168, 173.
Nélaton's guide, 168.
Table of, 174.
of Humerus, 206.
Sub-clavicular, 143, 146.
Sub-coracoid, 145.
Sub-glenoid, 141, 216.
Sub-spinous, 143, 144, 218.
Supra-coracoid, 145, 146.
of Jaw, 136, 139, 204.
bilateral, 137.
causes of, 136.
unilateral, 137, 138.
of Knee, 175.
of Os Magnum, 167.
of Patella, inward, 179.
outward, 179.
rotary, 180.
upward, 180.
of Radius, backward, 157.
forward, 157.
of Radius, forward, and Ulna, backward, 153.
of Scapula, 149.
of Shoulder Joint, 140.
Ruler test, 140.
Table of, 147.
of Tibia, backward, 177.
forward, 177.
lateral, 178.
rotary, 178.
of Ulna, backward, 156, 158.
forward, 158.
lower end, backward, 166.
Dislocations, of Ulna, lower end, forward, 166.
of Wrist, 160, 228, 229, 230.
Dropsy, Abdominal (Ascites), 445.
of Brain, 426.
of Joint, 49, 60.
Ovarian, 445.
Renal, 448.
Duchenne's disease, 492.
Symptoms of, 590.
Dysphagia, 492.

E.

Elephantiasis Arabum, 394.
Emboli in Veins, 3.
Embolic Abscesses, 467.
Embolism, 15, 22, 44, 461.
cerebral, 466.
Symptoms of, 518.
Emphalocele, 426, 427.
Encephalitis, 461, 470.
Encephalocele, 461, 468.
Enchondroma, 99, 114, 406, 407.
of Testicle, 260.
Enterocele, 341.
Entero-epiplocele, 341.
Entozoa of Bone, 100, 118.
Epididymitis, 268.
Epigastric Hernia, 340.
Reflex, 562.
Epilepsy, Symptoms of, 534.
Epileptiform attacks, 492.
Epiphyses, Separation of the, of Radius and Ulna, 230.
Epiplocele, 341.
Entero-, 341.
Epithelioma, 288, 326, 418, 429.
Epulis, 118.
Erysipelas, 392.
Cutaneous, 394, 404.
Internal, 384.
Phlegmonous, 394, 404.
Exomphalos, 340, 372.
Exostoses, 99, 115.
causes of, 116.
of Cranium, 116, 132, 424.
Eyes, Conjugate Deviation of, 480, 497.

F.

Face, Tumors of the, 422.
Facial Anæsthesia, 490.
Diplegia, Symptoms of, 513.
Neuralgia, 491.
Nerve, lesions of, 491.
Paralysis, 491.
Fatty degeneration of Arterial Coats, 3.
of Vessels, 5.
Flatfoot, 89, 92, 99, 95.
Focal lesions of cervical region of spinal cord, 567, 568, 569.
of dorsal region of spinal cord, 569, 570, 571.
of lateral half of spinal cord, 572, 573.
of lumbar region of spinal cord, 571, 572.
Foot-clonus, 562, 563.
Formication, 479, 481.
Fracture, at the Elbow, 219.
varieties of, 219.
at the Hip, 232.
Knee and Ankle, 241.
Shoulder, 205.
Wrist, 226.
Barton's, 226.
Colles', 162, 226, 228, 231.
Compound, of Ankle Joint, 245.
in general, in the vicinity of Joints, 253.
near the Wrist Joint, 226.
varieties of, 226.
of the Ankle, 243.
varieties of, 243.
of the Clavicle, 209.
inside of Coracoid Process, 211.

Fracture of the Clavicle, outside of Coracoid Process near the Conoid Ligament, 211.
symptoms of, 209.
of the Femur, neck of, 172, 240.
with inversion of foot, 170.
of the Hip, 232.
Extra-capsular, 235.
Extra-capsular, simple, 237.
Extra-capsular, with impaction, 236.
Intra-capsular, 236.
Intra-capsular, simple, 237.
Intra-capsular, with impaction, 235.
with inversion of the foot, 239.
distinct types of, 232.
of the Humerus above the Condyles, 151.
above the Condyles (transverse), 221.
Extra-capsular, simple, 213.
Impacted Extra-capsular, at Shoulder, 215.
Impacted Intra-capsular, at Shoulder, 215.
Inner Condyle of, 222.
Intra-capsular, simple, 213.
near Shoulder, 212.
near Shoulder, varieties of, 212.
Neck of, 141, 207, 216, 217.
Outer Condyle of, 222.
of the Jaw, Lower, 202, 204.
of the Jaw, Upper, 202.
of the Leg, in vicinity of Knee, 241.
of the Malleolus, Internal, 244.
of the Patella, 242.
of the Penis, 322, 328.
of the radius, upper end, 225.
of the Radius and Ulna near the Wrist, 229.
of the Ribs, 248, 250, 251, 252.
of the Scapula, Body of, 206.
Neck of, 207, 208, 217.
Spine of, 206.
of the Skull, 193.
Base, 199.
complete, 193.
Inner Table, 197, 198.
Outer Table, 193, 197.
of the Sternum, 246.
of the Tibia and Fibula in region of Ankle Joint, 183.
of the Trunk, 246.
of the Ulna, Coracoid Process, 223.
at Elbow, 220.
Olecranon Process, 223, 224.
Upper End of, 225.
of the Vertebræ, 246.
of the Wrist Joint, transverse, of both Bones, 164, 231.
Pott's, 244.
Separation of the Epiphyses of Radius and Ulna, 165.
Separation of the Great Trochanter of the Humerus, 218.
Special, 192.
Spontaneous, 99.
Symptoms of, in general, 190.
Varieties of, 189.
Fragilitas Ossium, 108.
Fæces, Impacted, 348, 365.
Femoral Canal, Lipoma of, 371.
Tumors in region of, 412.
Femoral Hernia, 340, 349, 367, 368, 369, 370, 371, 401.
Femur, Disease of the Trochanter, 81.
Femur, "Dorsum Ilii," Dislocation of, 169,
Fractures of, 232.
"Pubic," Dislocation of, 240.
"Sciatic Notch," Dislocation of, 239.
"Thyroid" Dislocation, 171.
Fibroma, 406.
Fissure of the Anus, 339, 357.
Fistula of the Rectum, 338, 357.
Fistulæ, Urethral, 317.
Foot, Fracture of the Femur, with inversion of the, 170, 239.
Fossæ, Iliac, Tumors in, 412.
Front-tap Contraction, 563.
Furuncle, 397.

G.

Ganglia, 407.
Gangrene, 467.
Dry, 468.
Hospital, 468.
Moist, 468.
of Bladder, 288.
General Paralysis of the insane, 283.
Gland, Axillary, Cancer of, 420.
Tubercular disease of, 420.
Enlarged, 349, 367.
Lymphatic, Tumors of, 409.
Parotid, Tumors of, 409.
Prostate, Atrophy of, 308.
Cancer of, 308.
Cystic disease of, 308.
Diseases of the, 307.
Hypertrophy of, 307.
Tubercle of, 308.
Tumors of, 410.
Wounds of the, 309.
Thyroid, Tumors of, 409.
Glanders, 406.
Glans Penis, Diseases of the, 325.
Glosso-pharyngeal Nerve, lesions of, 492.
Gluteal reflex, 561.
Gonorrhœal Inflammation, 313.
Gout, 50.
Rheumatic, 58, 66.
Groin, Tumors of, 412.
Gubler's line, 491.
Gummata, 327, 406.
Gums, Tumors of the, 408.

H.

Hæmatoma of Dura Mater, 468.
Symptoms of, 525.
Hæmatocele, 272, 286, 348, 407, 411.
of Testicle 259, 362.
Pelvic, 452.
Hæmorrhage of Spinal cord, 539.
Half-vision, 482.
Head, Double, 461, 463.
Tumors of the, 408, 422.
Hearing, Centres of, 487.
in Optic Thalamus, 502.
Modifications of, in Bell's paralysis, 491.
Hemianæsthesia, 480, 495.
cerebral, 481, 488.
Hemianopia, 482, 483.
Hemianopsia, 479, 482, 483, 486, 488.
Uncomplicated, 489.
Varieties of, 483.
with crossed paralysis, 489.
Hemiparaplegia, 574, 575.
Hemiplegia, 477, 478.
cerebral, 495.
Diagnosis of, 530.
Spinal, 573, 574.
Diagnosis of, 530.
Hemorrhage, Prostatic, 309.
Hemorrhoids, 338.
External, 352.
Internal, 352, 354.
Hernia, 340.
anatomical classification of, 340.
classified as to contents of sac, 341.
cerebral, 340, 341, 345.
condition of Bowel in, 346.
conditions of sac of, 341.
congenital, 284, 341, 346, 375, 376.
"cough impulse" of, 345.
Diaphragmatic, 340, 345, 347, 374.
differential diagnosis of, 348.

Hernia, Direct, 342.
Epigastric, 340.
External, 342.
Femoral, 340, 345, 349, 367, 368, 369, 371, 401.
Gluteal, 345.
Incarcerated, 341.
Infantile, 341, 376.
Internal, 342.
Indirect, 342.
Incomplete, 341.
Inguinal, 285, 340, 365, 366, 370.
direct, 358.
indirect, 356.
incomplete, 363.
nomenclature of, 342.
region, 348.
Inguino-labial, 340.
-scrotal, 340.
In Pelvic region, 340.
Irreducible, 341.
Ischiatic, 340.
Lumbar, 340.
Obturator, 340, 345.
of Abdominal Viscera, causes of, 342.
exciting causes of, 344.
predisposing causes of, 342.
of Bladder, 288.
of Kidney, 341.
of Liver, 341.
of Lung, 341, 411.
of Spleen, 341.
of Stomach, 341.
of Testis, 341.
pain as a symptom of, 345.
Perineal, 340, 345, 373.
Poupart's Ligament (above), 340.
(below), 340.
Pudendal, 340.
reducible, 341.
reducibility of, 346.
special types of, 342.
Sciatic, 345.
strangulated, 341.
Scrotal, 280, 281, 359, 360, 361, 362.
symptoms in general, 344.
Testis, 260, 267.
Thyroid, 373.
Umbilical, 340, 372.
Vaginal, 340.
Ventral, 340, 346, 372.
Herpes, 332.
Progenitalis, 325.
Hiccough, 492.
Humerus, Dislocation of, 208.
Extra-capsular Fracture of, at Shoulder (impacted), 215.
Extra-capsular Fracture of (simple), 213.
Intra-capsular Fracture of, at Shoulder (impacted), 215.
Intra-capsular, Fracture of (simple), 213.
Condyle of (inner), Fracture of, 222.
(outer), Fracture of, 222.
Fracture of the, near Shoulder Joint, 212.
Fracture of the, near Shoulder, varieties of, 212.
Fracture of the Neck of the, 207, 216, 217.
Separation of Great Tubercle of, 218.
Sub-clavicular dislocation of, 143, 145.
Sub-coracoid dislocation of, 145.
Sub-glenoid dislocation of, 141, 216.
Sub-spinous dislocation of, 218.
Supra-coracoid dislocation of, 145, 146.
transverse Fracture above the Condyles, 221.
Hydatids, 118, 448.
uterine, 440.
Hydrarthrosis, 49, 60, 65.
Hydrocele, 266, 272, 280, 284, 286, 375, 407.
congenital, 274.
diffuse of the Spermatic Cord, 275.
encysted, 283.
of the Spermatic Cord, 276.
of the Testicle, 274.
Hydrocele, of the Cord, 285, 348, 366.
of the Testicle, 348, 360.
Hydrocephalus, 461, 463.
chronic, 461, 469.
Symptoms of, 535.
Hydrops Articuli, 60.
Hydro-Sarcocele, 274.
Hydruria, 492.
Hyperæsthesia, 479, 482.
Hyperinosis, 465.
Hypertrophy of Prostate Gland, 307.
Hypoglossal nerve, lesions of, 492.

I.

Ichthyosis, 394.
Ilium, diseases of the crest of, 84.
Incoördination of Muscular movements, 557.
Infarction, 466, 467, 472.
Inflammation, 379,
acute, 380, 381.
symptoms of, 390.
catarrhal, 388.
causes of (exciting), 382.
(predisposing), 381.
classification of, 379.
cellular, 300.
constitutional effects of, 387.
chronic, 380, 381, 390.
chronic circumscribed, of Corpora Cavernosa, 328.
constitutional symptoms of croupous, in general, 389.
etiology of, 381.
Exudation in, varieties of, 388.
Fibrinous, 389.
Gonorrhœal, 313.
Heat of, its causes, 385.
Hyperplastic, 380.
Idiopathic, 380.
Infective, 380.
microscopical changes in, 384.
Necrotic, 380.
Necrotic-reparative, 380.
non-specific, 313.
of the Corpora Cavernosa, 327.
of larger Joints, diagnostic points of tenderness on pressure, 87.
of Lymphatic Structures, 390.
of Psoas Burse, 85.
of Serous Membranes, 389.
of Spinal Cord, 539.
pain of, its causes, 385.
pleuritic, 250.
rational symptoms of, 385.
redness of, its causes, 385.
results of inflammatory process (table), 393.
special types of (table), 388.
specific, 380.
swelling in, its causes, 385.
traumatic, 380.
theories as to causes of local inflammatory changes, 384.
Tubercular, 380.
Urethral, 50.
Vascular, 380.
Inguinal Canal, Tumors in region of, 412.
Hernia, 340, 370.
region, Hernia of the, 348.
Inguino-labial, Hernia, 340.
-scrotal Hernia, 340.
Injuries of Abdomen, 335.
Internal Capsule of Cerebrum, 494.
Intestinal Canal, foreign bodies in, 336.
Colic, 28.
Obstruction, 337, 349, 351.
causes of, 337.
symptoms of, 337.
varieties of, 351.
Intestine, diseases of the, 337.
Involucrum, 112.
Ischiatic Hernia, 340.

J.

Jacksonian Epilepsy, 493.
Symptoms of, 508.
Jaw, dislocation of, 136, 139, 204.
Bilateral, 137.
causes of, 136.
Congenital, 138.
Unilateral, 137, 138.
Lower, Fracture of, 202, 204.
Upper, Fracture of, 202.
Tumors of the, 408.
Joint, Anchylosis of, 60, 105.
varieties of, 60.
Ankle, deformity of, with injury acquired or congenital, 186.
diagnostic points of tenderness on pressure, 87.
Dislocation at, 181, 185, 186
Fracture of, 243.
(compound), 245.
(varieties of), 243.
Sprain of, 95.
Ankle and Knee, Fractures at, 241.
complications in locomotor ataxia, 559, 560.
Deformities of, 87.
acquired, 88.
or congenital, 49.
Diseases of, 49.
classification of, 49.
in general, 50, 64.
special, 70.
Dislocations of, special, 136.
Distortions of, congenital, 87.
Dropsy of, 49, 60.
Elbow, diagnostic points of tenderness on pressure, 87.
dislocation of, 149.
Table of, 159.
Fracture at, 219.
(varieties of), 219.
Elbow, Fracture of Ulna, 220.
Fractures in general in the vicinity of, 253.
Hip, Deformity of (Rheumatic), 83.
diagnostic points of tenderness on pressure, 87.
diseases of, 70.
Dislocation at, 168, 173.
congenital, 74, 77.
Nélaton's guide, 168.
Table of, 174.
Fracture of, 233.
(extra-capsular), 235.
(simple extra-capsular), 237.
(intra-capsular), 236.
(impacted intra-capsular), 235.
(simple intra-capsular), 237.
(with inversion of the foot), 239.
Knee, diagnostic points of tenderness on pressure, 87.
Dislocations at, 175.
Fracture of bones of the leg in the vicinity of the, 441.
Knee and Ankle, Fractures at, 241.
loose Cartilage in, 49, 62.
Malformations (congenital), 87.
Nodosity of, 58.
Periostitis near a, 122.
Shoulder, diagnostic points of tenderness on pressure, 87.
Dislocations at, 140.
Dislocation of, Table of, 147.
Fracture at, 205.
impacted extra-capsular of Humerus, 215.
impacted intra-capsular of Humerus, 215.
of the Humerus near the, 212.
of the Humerus, varieties of, 212.
Suppuration, external to a, 69.
Joint, Wrist, Dislocation of, 160, 228, 229, 230.
Fracture near, 226.
varieties of, 226.
of both bones near, 229.
transverse, of both bones near, 164.
Ganglion at, 167.
Sprain at, 163.

K.

Kidney, Hernia of, 341.
Kinesodic system of Spinal Cord, 539.
lesions of, 540.
Knee-jerk, 562.

L.

Labia, Tumors of, 410.
Larynx, Tumors of Mucous Membrane of, 409.
Leg, Barbadoes, 394.
Leukæmia, 406.
Ligament, Conoid, Fracture of the Clavicle outside of Coracoid Process near the, 211.
Poupart's, Hernia, above, 340.
below, 340.
Triangular, Rupture of the Urethra in front of, 321.
Rupture of the Urethra within the, 32.
Line of Gubler, 491.
Locomotor ataxia, 539, 555, 556, 557, 558, 559, 562, 583.
Symptoms of, 515.
Luy's Centre in Optic Thalamus, 501.
Lipoma, 406, 407.
of Femoral Canal, 349, 361.
of Spermatic Cord, 278.
of Testicle, 259.
Lips, Tumors of, 408.
Liver, Hernia of, 341.
Lumbar, Hernia, 340.
Lung, consolidation at apex of, 31.
Hernia of, 340, 341, 411.
Lupus, 395, 406, 429.
Vulgaris, 395.
Lymphatic Gland, Tumors of, 409.
Lymphoma, 406.

M.

Malacosteon, 108, 124.
Malformations, acquired and congenital, 49.
Mammæ, Hypertrophy of, 433.
Tumors of, 410.
Medulla Oblongata, absence of, 463.
Compression of, symptoms of, 492.
lesions of, 492.
Menière's disease, symptoms of, 534.
Meningitis, spinal, 588.
Merocele, 340.
Metastatic abscess, 467.
Microcephalic deformity, 463.
Mollities Ossium, 99, 108, 124.
Monoplegia, 477, 493, 495.
a guide to the use of the Trephine, 506.
Monopodia, 186.
Monorchidism, 262.
Morbus Coxarius, 70, 77, 78, 79, 81 to 86.
Acetabular, 72.
symptoms of, 72.
Arthritic, 72.
symptoms of, 72.
differential diagnosis of, 74.
Femoral, 72.
symptoms of, 72.
symptoms of, 71.
Morbus Coxæ Senilis, 58.
Motor Oculi nerve, lesions of, 489.
Paralysis, 476.
coëxisting with convulsions, 505.
symptoms of spinal lesions, 565.

Motor Tract, course of, 476, 477.
of Brain, 487.
Mouth, Tumors of the, 422.
Muscle, Cremaster, Spasm of, 279.
Muscles, atrophy of, 540.
Tumors of, 409.
Myelitis, 539.
central, 539, 554, 555.
of anterior horns of spinal cord, 547.
Spinal, of anterior horns, 539.
Symptoms of, 588, 589, 591.
Myoma, 406.
Myxoma, 406.

N.

Nævi, 39.
Nævus, 7.
Neck, Tumors of the, 409.
Necrosis, 111, 120.
changes in, 111.
Nerve, Auditory, lesions of, 492.
Fourth Cranial, lesions of, 490.
Glosso-pharyngeal, lesions of, 492.
Hypoglossal, lesions of, 492.
Motor oculi, lesions of, 489.
Olfactory, lesions of, 486.
Optic, lesions of, 486.
Phrenic, 566, 567.
Pneumogastric, lesions of, 492.
Recurrent Laryngeal, result of pressure upon, 13.
Sciatic, lesions of, 571, 572.
seventh cranial, lesions of, 491.
Spinal accessory, lesions of, 492.
Third cranial, lesions of, 489.
Trigeminus, lesions of, 490.
Ulnar, 566, 569.
lesions of, 581.
Nerves, Brachial plexus of, 566.
Spinal, 566.
Neuralgia, Articular, 49, 61.
of Intestine, 28.
of Rectum, 340.
of Testis, 263.
Neuroma, 406.
Numbness, 481.

O.

Olfactory Nerve, lesions of, 486.
Omphalocele, 340, 372.
Ovarian Cyst, 442.
compound, 407.
unilocular, 448.
Dropsy, 445.
Tumor, 449.
solid, 441.
Ovary, Tumor of the, 444.
(fluid), 447.
Omentum, Cancer of, 421.
Optic Nerve, lesions of, 486.
Thalamus, atrophy of, 463.
lesions of, 500.
Physiological function of, 501, 502, 503.
Special centres of, 500.
Osteitis, 99, 100, 102, 119, 121.
symptoms of, 101.
Osteo-Aneurism, 113.
Osteo-Arthritis, chronic, 58.
Osteo-Cystoma, 116.
Osteo-Malacia, 108, 124.
Osteo-Myelitis, 99, 101, 119.
symptoms of, 102.
Osteo-Sarcoma, 117.
Osteoma, 406.
Orbit, Tumors of the, 408.
Orchitis, 268.
Acute, 263.
Chronic, 261.
Inflammatory (simple), 257.
Malignant, 258, 265.
Syphilitic, 258, 264, 265.
Tubercular, 258, 264.
Obturator Hernia, 340.
Œdema, local, 398.
Œsophagus, Tumors of Mucous Membrane of, 409

P.

Pachydermia, 394.
Pachymeningitis, 461, 468.
Symptoms of, 526.
Pains of Locomotor Ataxia, 556, 557.
Papillomata, 405, 406.
Paralyzed Muscles, Contracture of, 570, 571.
late rigidity of, 498.
Rigidity of, 493.
Paralysis Agitans, 586.
Symptoms of, 532.
Bulbar, 492, 552.
Complete, 479, 488.
Cortical, 476, 493.
Symptoms of, 507.
Crossed, 478, 479.
symptoms of, 509, 510, 511, 512.
Facial, Bilateral, 513.
unilateral, 513.
from brain tumors, 474, 475.
from cerebral Meningitis, 468.
General axioms of, 540.
General, of the Insane, 583.
General syphilitic, 593.
Glosso-labio-pharyngeal, symptoms of, 520.
Infantile, 86.
Labio-glosso-pharyngeal, 492.
Motor, 462, 476.
Motor, coexisting with Anæsthesia, 505.
of profound, 505.
non-cortical, symptoms of, 507.
Ocular, 487.
bilateral, 488.
of Bell, 491.
of Bladder, 305.
of cerebral origin, symptoms of, 515.
of Duchenne, 492, 520.
of Face, 489.
of Palate, 491.
of special senses, 478.
of Taste, 491.
permanent, 493.
Pseudo hypertrophic, 539, 550, 552, 553, 554, 584, 585.
sensory, 462, 479.
Spastic, 545.
Spinal, 543.
acute, 547.
atrophic, 539.
General symptoms of, 544.
Infantile, 547.
Tetanoid, 539.
Transitory, 443.
with Hemianopsia, 486, 487.
with Muscular atrophy, 540.
with Spasms, 540.
Paraphimosis, 327.
Paraplegia, Functional, 587.
Hemi-, 574, 575.
Organic, 587.
Reflex, 591, 592.
Tetanoid, 582.
Parasites, 407.
of the Brain, 474.
Parotid Gland, Tumors of, 409.
Patella, Dislocation upward, 180.
lateral, 180.
rotary of, 180.
Reflex, 562.
Pharynx, Tumors of Mucous Membrane of, 409.
Psammoma, 406.
Pelvic region, Hernia in, 340.
Pelvis, Cordiform, 107.
Tumors of the, 450.
various types of, 450.
Penis, Anomalies of, 298.
Calcification of, 327.
Diseases of, 325.
Fracture of, 322, 338.

Perineal Abscess, 320.
Hernia, 340, 373.
Periosteal Abscess, 99.
Thickenings and Nodes, 99.
Periostitis, 99, 103, 121.
near a Joint, 122.
Syphilitic, near a Joint, 68.
types of, 103.
Peritonitis, Pelvic, 451.
Perityphlitis, 349, 350.
Peroneal Reflex, 562, 563.
Phlebectasis, 20.
Phlebitis, Adhesive, 3, 18, 22, 45.
Diffuse, 3, 19.
Suppurative, 19, 22, 45.
Phlebolites, 21, 309.
Plantar Reflex, 561.
Pneumogastric Nerve, lesions of, 492.
Pneumo-thorax, 251.
Pregnancy, 449.
extra-uterine, 452.
Tumor of, 438, 439, 440.
Prepuce, Diseases of, 326.
Phimosis, 326.
Poliomyelitis, acute, 547.
anterior, 547, 548, 549.
chronic, 548, 549.
Subacute, 548.
Symptoms of, 578, 579.
Polypus, Fibrous, 218.
Rectal, 239, 354, 355.
Uterine, 443.
Vaginal, 453.
Pons Varolii, absence of, 463.
Posthitis, 325.
Post-paralytic rigidity, 477.
Poupart's Ligament, Hernia above, 340.
below, 340.
Primary Lateral sclerosis, 545, 546.
Process, Coracoid, Fracture of Clavicle inside of, 211.
Fracture of Clavicle outside of, near Conoid Ligament, 211.
Coronoid, Fracture of, of Ulna, 223.
Olecranon, Fracture of, of Ulna, 223, 224.
Progressive Muscular atrophy, 539, 550, 551, 552, 579, 584, 585.
Prolapse of Rectum, 338.
Prostate Gland, Atrophy of, 308.
Cancer of, 308.
Diseases of, 307.
(cystic), 308.
(inflammatory), 307.
Hypertrophy of, 307, 312, 333.
Tubercle of, 308.
Tumors of, 410.
Wounds of, 309.
Pseudo hypertrophic Paralysis, 539, 550, 552, 553, 554, 584, 585.
Prostatic Enlargement, 307.
Prostatitis, acute, 307, 311.
chronic, 308, 307, 311.
Psoas Abscess, 401.
Ptosis, 474, 489.
Pudendal Hernia, 340.
Pruritus Ani, 339.
Pyæmia, 16, 50, 380, 465, 471.

R.

Radius, Fracture of upper end of, 225.
of (transverse, above the wrist), 231.
Separation of the Epiphyses, 230.
Ranula, 407.
Rectal Prolapse, 355.
Rectocele, 341, 345.
Rectum, Cancer of, 339, 356.
Diseases of, 338.
Fistula of, 33, 357.
Neuralgia of, 340.
Polypus of, 339.
Prolapse of, 338.
Stricture of, 339, 356.
Tumors of, 410.
Reflex Paraplegia, 591, 592.
Reflexes, Spinal. See Spinal Reflexes.
Reflex tests, 561, 562, 563.
Renal Colic, 28.
Respiratory Centre, 567.
Rheumatism, 50, 64.
chronic, 58.
Ribs, Fracture of, 248, 250, 251, 252.
Rickets, 106, 124.
causes of, 106.
symptoms of, 108.
Robertson pupil, 559.
Rupture of Bladder, 288.
of Triceps Tendon, 224.
of Urethra in Membranous portion, 321.
in front of Scrotum, 322.
in front of Triangular Ligament, 320.
within the Triangular Ligament, 320.
Urethral, 316.

S.

Sacro-iliac Disease, 75, 79.
Sarcocele, 359.
Hydro-, 274.
of Testicle, 348.
Sarcoma, 406, 407.
Cystic, 258.
of Testis, 270.
Scalp, Tumors of, 408.
(fatty), 423.
(sebaceous), 423.
Scapula, Fracture of the body of, 206.
neck of, 207, 208, 217.
spine of, 206.
Scapular Reflex, 562.
Sclerosis, Amyotrophic lateral, 539.
Cerebro-spinal, 586.
Lateral, Amyotrophic, 549, 550.
Lateral, primary, 545.
Lateral, secondary, 546, 547.
of Anterior Columns of Spinal Cord, 534, 544.
of bone, 101.
of Brain, 473.
of Columns of Goll and Burdach, 539.
of lateral columns of Spinal Cord, 539.
of lateral columns of Spinal Cord, Symptoms of, 576.
of Posterior columns of Spinal Cord, 555, 556, 557, 558, 559, 560.
of Postero-lateral columns of Spinal Cord, 545.
of Spinal Cord, 539.
Spinal, of Cerebral origin, Symptoms of, 576.
Spinal, Primary, Symptoms of, 577.
Spinal, Secondary, symptoms of, 577.
Secondary lateral sclerosis, 546.
Sensation, delayed, 480, 557.
Sensory Paralysis, 479.
Symptoms, 543.
axioms of, 540.
of Spinal lesions, 565.
Sensory Tract of Brain, 487.
Shaking Palsy, Symptoms of, 532.
Sight, centre of, in Optic Thalamus, 501.
Smell, centre of, 496, 497.
centre of, in Optic Thalamus, 500.
Destruction of, 496.
Softening of the Brain, 473.
Spasmodic tables, 545.
Spasm of Cremaster Muscles, 279.
Spasm, Urethral, 318.
Spastic Paralysis, 545.
Special senses, Impairment of, with Paralysis, 480.
in cerebral lesions, 496.
Sprain, severe, 185.
Separation of the Great Tubercle of Humerus, 144.
Speech, Broca's centre of, 484.
Spermatic Cord, diseases of Tunica Vaginalis and the, 273.

Spermatic Cord, diffused Hydrocele of, 275.
encysted Hydrocele of, 276.
Lipoma of, 278.
Varicocele of, and Testicle, 277.
Spleen, Enlargement of, 402, 421.
Hernia of, 341.
Sternum, Fractures of, 246.
Spina Bifida, 454, 456, 539.
Ventosa, 100, 125.
Spinal Accessory Nerve, lesions of, 492.
Spinal Cord, absence of, 463.
Aesthesodic system of, 539.
Anterior columns of, sclerosis of, 544.
Cervical region of, focal lesions of, 567, 568, 569.
Columns of, 541.
Commissural fibres of, 241.
Congenital abnormalities of, 539.
Degeneration of, 539.
Diseases of, 539.
Dorsal region of, focal lesions of, 569, 570, 571.
Focal lesions of, 539, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575.
Gray Matter of, 541, 542.
Hæmorrhage of, 539.
Inflammation of, 539.
Kinesodic system of, 539.
Lateral half of, focal lesions of, 572, 573.
Lumbar region of, focal lesions of, 571, 572.
Motor fibres of, 541.
Non-systematic lesions of, 560 to 575 inclusive.
Physiology of, 541.
Posterior Columns of, sclerosis of, 555 to 560 inclusive.
Postero-lateral Columns of, sclerosis of, 545.
Sclerosis of, 539.
Sensory fibres of, 541.
symptoms of lesions of, 543.
Systematic lesions of, 539.
Trophic centres of, 541.
Tumors of, 539.
Spinal Epilepsy, 560, 570.
Hemiplegia, 530, 573, 574.
Meningitis, Symptoms of, 588, 589, 590.
Nerves as Guides in diagnosis, 266, 567.
Paralysis, varieties of, 543.
Reflexes, 540, 541, 543, 561, 562, 563.
axioms of, 563, 564.
deep, 562, 563, 564.
Superficial, 561, 562.
Segments, 541, 542, 561.
Symptoms, axioms of, 540.
Spine, lateral curvature of, 82.
Tumors of, 454.
varieties of, 454.
Stricture, Congestive, of Urethra, 318.
of Rectum, 339, 356.
Urethral organic, 312, 313, 323, 324.
Sores, Venereal, 326.
Scrofula, 50.
Scrotal Hernia, 359 to 362.
Hernia, inguino-, 340.
Scrotum, Rupture of Urethra in front of, 322.
Stomach, Hernia of, 341.
Stone in Bladder, 291, 300, 304.
etiology of, 291.
physical signs of, 294.
rational symptoms of, 293.
steps for sounding, 295.
Skull, Fractures of, 193.
at base, 199.
complete, 193.
of Inner Table of, 197, 198.
of outer Table of, 193, 197.
varieties of, 193.
Strabismus, 474, 489, 490.
Sympodia, 186.
Syndactylus, 186.
Synostosis, 60.
Synovitis, 49, 50, 60, 64, 108.
acute, 51.
chronic, 53.
Gonorrhœal, 55.
Pyæmic, 55.
Rheumatic, 54.
Scrofulous, 53, 65.
Suppurative, 52.
symptoms of, 51.
Syphilitic, 56.
Syphilis, 50, 465, 471.
Syphilitic, General Paralysis, 598.
Orchitis, 264, 265.
Testis, 290.
Ulcers, 313.

T.

Tabes Dorsalis, 555, 556, 557, 558, 559.
Symptoms of, 515.
Talipes, 88,
Calcaneous, 89.
Calcaneo-valgus, 89, 92.
Equinus, 9, 89.
Equino-varus, 89.
Spurio-valgus, 89, 92, 93, 95.
Valgus, 89, 92, 93.
Varus, 89, 90.
Taste, centre of, 497.
Traumatic Aneurism, 9.
Tendo-Achilles reflex, 562.
Tendon, Rupture of the Triceps, 224.
Testicle, Cancer of, 267.
Hæmatocele of, 362.
Hydrocele of, 348, 360.
encysted, 274.
Retraction of, 279.
Sarcocele of, 348.
table for diagnosis of diseases of, 270.
Tumors of, 410.
undescended, 348, 364.
Varicocele of Spermatic Cord, 277.
Testis, Cysts of, 266, 283.
Hernia, 267, 341.
malignant, 270.
Neuralgia of, 268.
Sarcoma of, 270.
Syphilitic, 270.
Tubercular, 270.
Tetanoid Paralysis, 539.
Paraplegia, 545, 582.
Tetanus, Symptoms of, 590.
Tremor, 498.
Trephine, Rules for use of, 505.
Trephining, Contra indications against, 505.
Tissues, Conditions of, inflammatory, 391.
diseases of, 379.
Emphysema of, 252.
Gangrene of, 392.
Induration of, 391.
Suppuration of, 391.
Tumefaction of, 391.
Ulceration of, 391.
Trigeminal Nerve, lesions of, 490.
Tongue, Tumors of, 408.
Touch, Sense of, centre of, 497.
Thoracic Aneurism, 8, 30, 31.
of Aortic Arch, symptoms of, 12.
of ascending portion of Arch of Aorta, 12.
Thromballosis, 18.
Thrombi in Veins, 3.
Thrombosis, 16, 22, 44.
Arterial, 461.
Cerebral, 465.
Symptoms of, 518.
Venous, 461.
Tubercle, 406.
of Prostate Gland, 308.
Tubercular Testis, 270.
TUMOR or TUMORS.
Abdominal, 27.
Aneurism, effects of, pressure upon, 11.

Tumors, Aneurismal, growth of, 10.
in general, symptoms of, 10.
situations of, 10.
Atheromatous, 407.
Benign, 416.
classes of, 405.
Congenital, fatty, 456.
Cystic, 406, 407.
classification of, 407.
Erectile, 24, 38.
External, sudden appearance of, 345.
Extra-cranial, 131, 425.
Fibro-cystic, 117.
Glandular, 405.
Hernial, character of, 345.
surface of, 345.
weight of, 345.
in Iliac Fossa, 412.
in region of Femoral Canal, 412.
of Inguinal Canal, 412.
Intra-cranial, 131, 425.
Intra-thoracic, 30.
Malignant, 416.
Mediastinal, 374.
of Antrum, 408.
cystic, 130.
malignant, 130.
solid, 129, 428.
of Axilla, 411.
of Bladder, 288.
of Brain, 408, 474.
of Breast, 430.
glandular, 432, 433.
innocent, 434.
varieties of, 430.
of Bone, 99.
colloid, 100.
cystic, 100, 116.
Encephaloid, 100.
fibrous, 100, 118.
fibrocystic, 100.
malignant, 100, 114.
malignant cysts, 100.
non-malignant, 99.
pulsatile, 34, 100, 113, 126, 128.
Scirrhous, 100.
of Cranium, 422.
of Face, 422.
of Groin, 412.
of Gums, 408.
of Head, 408, 422.
of Integument, 409.
of Jaws, 408.
of Labia, 410.
of Larynx, Mucous Membrane of, 409
of Lips, 408.
of Lymphatic Glands, 409.
of Mammæ, 410.
of Mouth, 422.
of Muscles, 409.
of Neck, 409.
of Orbit, 408.
of Ovary, 444.
(fluid), 447.
(solid), 441.
of Œsophagus, of Mucous Membrane of, 409.
of Parotid Gland, 409.
of Pharynx, of Mucous Membrane of, 409.
of Pelvis, 450.
varieties of, 450.
of Pregnancy, 437, 439.
of Prostate gland, 410.
of Rectum, 410.
of Scalp, 408.
(fatty), 423.
(sebaceous), 423.
of Spinal Cord, 539.
of Spine, 454.
varieties of, 454.
of Testicle, 410.
(fibrous), 259.
of Tongue, 408.
of Trunk, 410.
Tumors, of Thyroid Gland, 409.
of Uterus, 410, 436.
fibroid, 438.
of Veins, varicose, 3.
of Vessels, 409.
on Artery, 23.
Ovarian, 449.
solid, 441.
Sanguineous, 407.
Sebaceous, 132, 424.
(true), 407.
solid, classification of types, 406.
solid, types of, 405.
Urethral, 317, 324.
Uterine (fibroid), 441, 443.
Tunica Vaginalis, diseases of the, and of Spermatic Cord, 273.
Türck's Columns, 541.
Trunk, Fractures of, 246.
Tumors of, 410.
Typhlitis, 349, 350.
Thyroid Gland, Tumors of, 409.
Hernia, 373.

U.

Ulna, Fracture of the, at the elbow, 220.
at Coronoid Process of, 223.
Olecranon Process of, 223, 224.
upper end of the, 225.
Fracture (transverse) of, above the wrist, 231.
separation of Epiphyses of, 230.
Ulnar Aneurism, 18.
Ulcer or Ulcers.
Chancroidal, 313.
Local, 313.
of the Anus, 339.
Syphilitic, 313.
Venereal, 326.
Ulceration, 288.
Lupoid, 395.
Urethra, diseases of the, 313.
diseases of the, affecting structure of its Coats, 313.
foreign bodies in the, 319.
inflammatory diseases of, 313.
Rupture of the, 316.
Rupture of the, in membranous portion, 321.
Rupture of the, in front of Scrotum, 322.
Rupture of the, in front of Triangular Ligament, 321.
Rupture of the, within the Triangular Ligament, 320.
Stricture of (organic), 312, 313, 323, 324.
(congestive), 318.
(spasmodic), 318.
Urethral Abscess, 317.
Calculi, 318.
Deformities, 317.
Dilatation, 316.
Fistulæ, 317.
Inflammation, 50.
Spasm, 318.
Tumors, 317, 324.
Urethritis, 313.
Uterus, Congestive Hyperæmia of, 437.
Inversion of, 436.
Tumors of, 410, 436.
(fibrous), 438.
(fibroid), 439.
Umbilical Hernia, 340, 372.
Unilateral Spinal Sclerosis of lateral column, 576.
Urine, conditions impeding the normal exit of, and independent of structural changes, 318.
Incontinence of, 303.
Retention of, 301, 302, 303.
Suppression of, 302.

V.

Vaginal Hernia, 340.
Varicocele, 277, 281, 348, 361.
causes of, 278.
of the Spermatic Cord and Testicle, 277.

Varicose Aneurism, 8.
Varix, 20.
Aneurismal, 7. 8, 36, 41.
Arterial, 7.
of Saphenous Vein, 349, 369.
Vegetations (venereal), 326.
VEIN or VEINS.
Atrophy of, 17.
Calcification of, 17.
Calculi of, 21.
Degeneration of (amyloid), 18.
(cancerous), 18.
(fatty), 17.
diseases of, 3, 17.
Inflammation of (adhesive), 3.
(suppurative), 3.
Innominate, result of pressure upon, 13.
obstruction to, from Emboli, Thrombi, etc., 3.
Parasites of, 3, 21.
Tumors of (varicose), 3.
Varix of Saphenous, 349, 369.
Varices of, 22.
Varicose, 20, 42.
Venereal Sores, 326.
Ulcers, 326.
Venous Coats, Atrophy of, 3.
Degeneration of, 3, 17.
Hypertrophy of, 3, 17.
Ventral Hernia, 340, 347, 372.
Vertebræ, Fractures of the, 246.
Vesical Calculi, appearance and consistency of, 292.
diagnosis of, 291.
etiology of, 291.
number of, 293.
shape of, 293.
symptoms of, 293.
Vesical Walls, Suppuration of, 298.
Vessels, Atheroma of, 43.
Degeneration of (cancerous), 43.
(fatty), 5, 43.
fibroid, 461.
diseases affecting calibre of, 3, 7.
Exposure of, 9.
Tumors of, 409.
Viscera, Abdominal Hernia of, causes of, 342.
Abdominal Hernia of, exciting causes of, 344.
Abdominal Hernia of, predisposing causes of, 342.
Volvulus, 337.
Vomiting, 492.
Symptoms of cerebral disease, 505.

W.

Warts, Venereal, 326.
Wounds of the Abdomen, 335.